POPULAR SCIENCE MONTHLY
SUMNER N. BLOSSOM, Editor
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Millions of Americans Are Committing
SLOW SUICIDE

Stealthy poisons are to be found in at least 92 percent of illegal liquor—What they do to the human body—An impartial investigation into the medical and chemical aspects of prohibition

By Donald Wilhelm

A NEW chemical warfare is ravaging the bodies of millions of Americans, threatening the general health of the nation. To combat it seems a task more difficult than protecting an army against military poison gases.

It challenges doctors and public health officials more than infant mortality, more than ordinary epidemics, more than keeping our milk, our drinking water and our food supplies free of pollution. I refer to the tremendous problem presented by the fact that millions of apparently intelligent Americans are daily poisoning themselves by drinking the deadly chemical concoctions which have been developed as substitutes for the conventional alcoholic beverages taken away by Prohibition.

It is as if they had resolved on a gigantic dance of death in the full of the moon; as if, by crazy incantations to sociability, they had hypnotized themselves into believing that cyanide of potassium, for instance, is a wholesome drink.

Cyanide of potassium, any chemical textbook will tell you, is a deadly poison—one of the most violent. A few drops will kill a man—will kill a horse.

And yet, only the other day, in an enlightened Massachusetts city where a great electrical industry uses many barrels of industrial alcohol, I was offered a drink by a gay young man, a chemist. "It's perfectly good gin," he assured me. "*We* make it!"

"But tell him *how* we make it," his equally buoyant roommate broke in.

"This is how: Some of the alcohol used in the plant contains a small quantity of cyanide of potassium. Somebody discovered that, if you shake this alcohol with skim milk, the cyanide combines with the milk and settles to the bottom. Then we siphon off the top."

I shook my head, and declined the drink. Their method sounded about as conducive to safety as crossing your fingers when you're falling out of an airplane; about as reasonable as melting the solidified alcohol used for heat and pouring it through a silk handkerchief to purify it—a system of obtaining "potable" alcohol that was popular in a certain western state that I visited last winter.

And the next day, in the same enlightened state, in another city where is a plant making imitation ivory toilet articles, I was offered another drink.

My host explained: "Our bootlegger gets his alcohol from the plant. It is perfectly good alcohol except that it is denatured with a little menthol. Some local people have drunk too much of it and got digestive trouble. But a little won't hurt you."

I DUG into my pocket for a leaflet every long-lifer needs to carry in his bill fold these days. The Government Printing Office in Washington charges five cents for it. It is called "Appendix to Regulations No. 61, Formulae for Completely and Specially Denatured Alcohol." In it are set down forty-seven formulae with which manufacturers of industrial alcohol must comply in order to make the alcohol they sell undrinkable. Formula No. 1 specifies that industrial alcohol to be used for any of more than a hundred manufacturing purposes, including the manufacture of imitation ivory, must be denatured by the addition to every 100 gallons "of *five gallons approved wood alcohol.*" Quite different from "a little menthol"!

Somebody had lied. But lies about hooch constitute the new communicable disease.

Poisonous substances such as wood alcohol, however, tell no lies when we

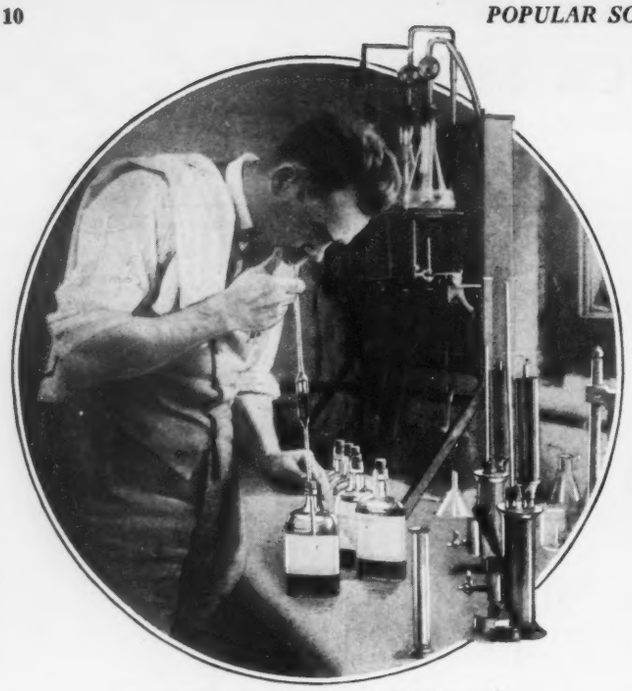
The Real Problem of Prohibition

IN THE arguments about prohibition, almost everything has been discussed except the one fact which concerns the public more immediately, perhaps, than any other; namely, that rank poisons are stealing into the stomachs of millions of Americans under the guise of whiskey, gin, wine and beer.

How dangerous are these concoctions? Just what are the risks in drinking the brews from cellar stills like the one pictured here? Is America confronted with a new and insidious enemy to health and safety?

In this article, an experienced investigator and writer gives the best available answers to these questions. In presenting the startling facts as Mr. Wilhelm has found them, POPULAR SCIENCE MONTHLY *holds no brief either for or against prohibition. Our purpose is simply to tell what everyone wants to know—that is, what the 1926 brand of "hooch" has in it.*

—The Editor.



Even Homemade Wine Holds Dangers

Wine is being made today in countless homes; yet few Americans, say experts, understand the precautions necessary to safeguard it from harmful impurities—such precautions as aging and preventing contact with metal. Here is Hugo Ringstrom, a chemist for the Internal Revenue Bureau, tasting and testing various wines

drink them! Wood alcohol keeps its promises, does exactly what it is expected to do when taken into our bodies—how quickly is merely a matter of conditions and how tough is the body. "In general," says Dr. Frank P. Underhill, professor of pharmacology and toxicology at Yale, "the fatal dose varies between one and two ounces."

Our public hospitals, private sanitariums and doctors every day are treating men and women prostrated or blinded by wood alcohol, or suffering from the cumulative effect of small quantities used over a period of time. For wood alcohol isn't burned promptly by the body to carbon dioxide and water, as grain alcohol is.

"WITH methyl (wood) alcohol poisoning," says Dr. Underhill, "the stage of excitement characteristic of ethyl (grain) alcohol is usually absent. Instead, the most outstanding feature is depression and weakness. There is headache, nausea, vomiting, violent abdominal pains, muscular incoördination, weak, rapid pulse, dyspnoea, cyanosis, restlessness, non-sensitive, dilated pupils, low temperature, cold, moist skin, sometimes delirium, generally coma, infrequently convulsions, and death from respiratory failure. Total blindness may be sudden."

Since nowadays the typical man knows more about his body—and less about his drink—than the typical physician knew fifty years ago, it is worth adding that methyl and ethyl alcohol are only part of the alcohol family.

There is also amyl alcohol—seven kinds—any of them five times more poisonous than ethyl or grain alcohol. But the most popular nowadays is commonly known as fusel oil.

Fusel oil is formed in fermentation. Unless you know more about chemistry than chemists, and more about quantity production of liquor than distillers, the only way you can rid new liquor of fusel oil is to age it, as long as twenty years, in charred barrels. And our modern hooch isn't aged. It isn't made in distilleries, under government supervision. It isn't, except in rare instances, made under the direction of chemists. It is made mostly by ignorant, irresponsible people from ensilage fermented for cattle; from solidified fuel alcohol; from derivatives of soap connived in a city factory. It is made in swamps and mountain fastnesses where stagnant water is used in the mash, where the mash is exposed to bacteria, where mice, rats and other animals, drowned, have been found in the mash. Lye has been used to hasten fermentation; pomanganate of potash, a deadly poison, "ages" the product. Creosote is used to give it a "bead." It is made in dingy cellars, tenements, attics, garages, homes, in laundry and bath tubs, in stills devised from auto parts, and other old metal. And the results are known from hospitals and sanitariums, from doctors, from insurance company reports, and from other authoritative sources!

Government officials estimate that 600,000,000 gallons of industrial alcohol denatured with the many poisonous substances indicated in the booklet I mentioned above are renatured annually by bootleggers—three and one half billions of dollars' worth of hooch at five dollars a quart!

As much hooch again probably is being made "from the ground up," that is, by distillation. About forty million dollars' worth, the Department of Commerce estimates, is being smuggled across our 17,500 miles of border line. All of this latter, except an occasional bottle, is made synthetically in Canada or on Rum Row ships, or, if genuine, is diluted—"cut"—before it is put on the market.

THE result is that government chemists in twenty-two division laboratories in as many parts of the country, engaged continuously with nothing except the analysis of seized liquor, have found that, among 100 specimens of hooch, from ninety-two to 100 not only are not up to the old-time standard of whiskey, but are actually rank poison!

In other words, wherever you drink in the United States these days, your chances of obtaining "real stuff" are never better than eight in a hundred!

Recently I talked with a bio-chemist in a great university who has given years to studying the effect of poisons on our bodies. "It is too bad," he told me, "that people generally know so little about chemistry. Everyone ought to learn that you can't make good liquor in a day. It's a dreadful tragedy in knockabout farce, this idea that you can run denatured alcohol through a still just once and get pure alcohol.

"AS A matter of fact, you can't, even by the most precise fractional distillation, obtain pure alcohol the first time. There is overlapping. Distillation begins before the boiling point is reached, and the boiling point of the many denaturants varies. Grain alcohol, for instance, boils at seventy-eight degrees centigrade—and I doubt if most bootleggers know what 'centigrade' means. But the amyl alcohols, including fusel oil, an oily liquid that mixes in all proportions with alcohol, ether and benzene, come over between one hundred and one hundred thirty-seven degrees. And, on the other hand, to go no further, the acid aldehydes come over at around twenty degrees, early in the game, along with some of the other aldehydes, which means that these poisons are not removed, or even reduced necessarily, by distillation. They are merely removed from one container to another.

"In distilleries, where they had the finest equipment, the greatest care was taken to get rid of such poisonous substances as the aldehydes and fusel oil. Hence the heads and tails—the first and last parts of the distillate—were thrown away. Our manufacturing bootleggers, who use all kinds of crude equipment, can't possibly know and apply the niceties. Besides, they're after quantity.

A Poison Peddler

A belt like this, concealed beneath the coat, is one of the bootlegger's favorite ways of carrying his goods. The chances of getting "real stuff" from him are about 8 in 100

"BUT even though some may use the whole range of distillation, most of the hooch on the market is a devil's brew like nothing ever seen in a laboratory. It's *poison!* It might be less injurious if it were aged. But when you consider that it was always a disputed question among medical men and physiologists as to whether the best product of the old distilleries, scientifically made and properly aged, actually was 'fit to drink,' what can you say about the present-day hooch?"

I asked an attending physician at a great hospital in Boston, "What can you say about the present-day hooch—what's it doing to our bodies?"

"In the old days," he answered, "alcoholic poisoning was alcoholic poisoning. Whiskey was whiskey, wine was wine, beer was beer, alcohol was alcohol. So we had an alcoholic ward, logically. We find now in the medical wards symptoms that are, yet aren't, alcoholic. We're having to revise our knowledge of symptoms. Diagnosis has become a fine art."

I WENT to a practicing physician in Philadelphia with the same question, "What is the present-day hooch doing to our bodies?"

"Without question," he said, "many poisonous substances heretofore used to end life are now being drunk cheerfully by millions of Americans. It's past me! In every second home to which I go, people are making things to drink which they call whiskey, wine or beer.

"Wine making is an ancient art we Americans don't understand. I am told that the casks used should be sulphured. I am told that no metal should be brought into contact with the wine. I doubt if these precautions are observed. Many people here are making beer which I understand is like making cheese. If it spoils right, you get beer; if it spoils wrong, you get something else. I imagine that it usually spoils wrong, because of the way it's made. Breweries used to be almost surgically clean. They had to be, or the beer spoiled wrong. It was a matter of good business. Special cultured yeasts no longer obtainable by the public were used. Wild yeasts are injurious. I can only guess how many families are consuming bacteria we doctors wouldn't recognize under a microscope!"

An industrial chemist in New York City, who makes tests for bootleggers, said, "I am not often called in to test beer, though it is estimated that thirty million small barrels a year, about half as much as was made in pre-Volstead days, are now being made. But in what I have tested, I have found acid-forming and other bacteria such as is present in spoiled food. In some instances I have found a pathogenic or disease-breeding condition."

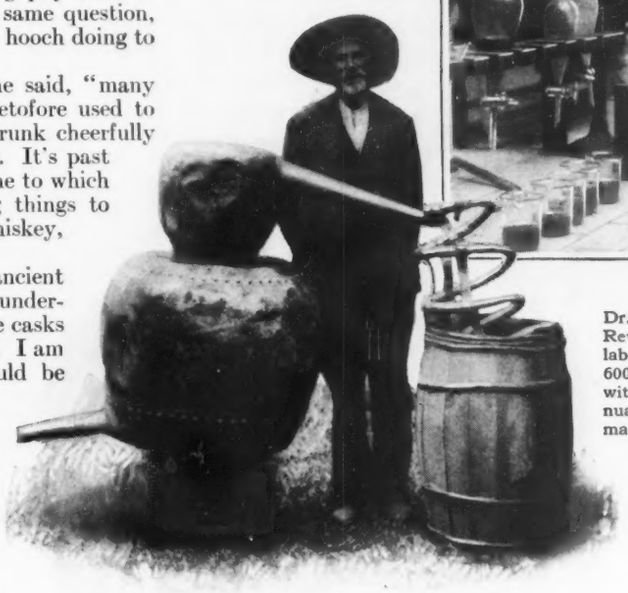
I had learned from railroad figures that shipments of grapes from California had increased 500 percent in five years; that the total from California, not to count shipments from other states and consumption locally in many parts of the country, aggregated 74,834 cars in 1925. So I asked the chemist about wine.

"MANY people are making wine," he said. "Much of it is made in foreign settlements where whole families crush the grapes—generally with their feet! Usually it is aged for a few months, and kept for family use, because there isn't the market demand for it that exists for hooch. Hooch is the main interest of a lot of chemists. By the way, I asked one bootlegger why he bothered to hire a chemist. 'It's good business,' he told me. 'A dead customer never buys the stuff!'"

He added: "Most of them don't care a hang, can't or won't understand what the stuff they're marketing does to a drinker's body. Why, one of the most prosperous bootleggers I know landed in the alcoholic ward of Bellevue Hospital not long ago!"

"The Devil's Brew"

The moonshine stuff that comprises much of modern hooch is made mostly by ignorant, irresponsible people, sometimes under filthy conditions. Virtually all of it contains deadly poisons. Below, a local officer is displaying a typical fifty-gallon moonshine still



Nine Out of Ten Not Safe

Dr. William V. Linder, chief chemist of the Internal Revenue Bureau, testing specimens of "hooch" in his laboratory. Government officials estimate that 600,000,000 gallons of industrial alcohol denatured with many poisonous substances are re-natured annually by bootleggers. As much again probably is made "from the ground up"—by means of distillation

SO I WENT, in my quest to find out what the new hooch and its new chemistry does to the human body, to Bellevue. There the busiest ambulances in the world assemble all manner of emergency cases from five of the boroughs of New York City. The alcoholic wards for both women and men are smaller, I found, than they used to be, partly because many of the patients brought in now are unconscious, and may have fractured skulls, or be suffering from any of a large new number of weird kinds of poisoning, and are sent immediately for treatment in the medical wards rather than in the alcoholic ward.

There are fewer cases of delirium tremens in Bellevue now than there used to be; fewer suffering from prolonged convulsions and wrist drop. There are fewer "repeaters"—old-timers returning again and again. There are fewer real old soaks of the kind that were associated with the three-cent whiskey that was like modern hooch, though not so destructive, I am told. The new stuff has eliminated the old soaks. They couldn't stand it! Only a few weeks back a porter at Bellevue went to a "speak-easy" for an afternoon drink. At seven he was brought in. An hour or so later he was dead.

There is a great increase, however, in the proportion of cases suffering from coma and from hallucinosis—obsession with the idea that armies, or relatives, or fiends of various sorts, are trying to kill them. In contrast with the cases in the old days, they die promptly or they clear up promptly. And why? "Because," one of the Bellevue physicians told me, "it took a long period of drinking in the old days to land a man here. He had to be saturated. It took weeks or months perhaps to get him saturated. And it took as long to get him cleared up. With present-day hooch, though, he can't get saturated. He collapses—maybe dies—long before he reaches that point.

"I account for the hallucinosis and our greater turnover by the presence in much of the modern hooch of ether and other volatile substances added to drinks to give them a 'kick.'"

Ether mixes readily with alcohol, and when so mixed the body tolerates it to some extent; but when it is taken raw an ounce is sufficient to cause death.

Ether taken in drinks has caused death at Bellevue. So has benzene, a coal-tar product not to be confused with benzine, a petroleum product with which you clean your clothes. So have fusel oil, wood alcohol, formaldehyde, di-ethyl pythalate, and pyridine, all of which are used as denaturants.

BUT they are only a few of the denaturants used. Moreover, federal government requirements stipulate that in many instances two or more shall be used in combination. Thus, to every 100 gallons of alcohol to be used in photographic work, the manufacturer must add "sixty-five pounds sulphuric ether, three pounds cadium iodide, and three pounds ammonium iodide." Among still others used are acetaldehyde and soap, chloroform and shellac, acetic and tannic acid, acetone, camphor and nitro-benzene, which is used in the preparation of explosives and in the making of inks, shoe dyes and suicides. Add also aniline, a coal-tar product used in dyes; phenol or carbolic acid; pyrrol and ipecac, the emetic. Add sulphuric acid, various essential oils, quinine, ammonia, nicotine, iodine, mythlene blue, methyl salicylate, and brucine, first cousin of strychnine.

Various of this second string of denaturants, singly or (*Continued on page 114*)

What's Wrong?-- $1,000 *in* PRIZES

MARY'S baby nephew has come to visit the Newlyweds, and they are having their troubles. The baby has fallen downstairs twice. John and Mary decide on "safety first" measures, so they begin building a gate above the top step on the first floor landing. What things are they doing wrong, and why are they wrong? What mistakes has the artist made in drawing the picture? Send answers not later than July 30

Find the Mistakes in This Picture

IF IT is true, as Sam Loyd observes, that "the successful ones are those who have a natural faculty for solving puzzles," then the number of successful people is increasing surprisingly every day. For each day's mail brings hundreds of additions to the thousands of POPULAR SCIENCE MONTHLY readers who are finding fascinating entertainment and profit in our great series of monthly $1,000 Picture Contests.

Many have written telling us that in searching the Contest pictures for the mistakes of John and Mary Newlywed and for the hidden errors of the artist, their minds have been made more alert, their powers of observation sharpened, and they have learned to do many useful small jobs around their own homes.

"I count John and Mary among the best friends I have," writes a contractor from Des Moines, Iowa. "Every month when I meet this energetic young couple between the covers of POPULAR SCIENCE MONTHLY, I learn something new from them. They are the kind of friends a man likes to make and keep, for they are always stimulating. They keep you guessing and they make you think. As they go about their jobs of homemaking, they are forever challenging you to catch them in a mistake. And no matter how much you may criticize them, they never hold it against you."

Have you made friends yet with John and Mary? If not, you have been missing a lot of worth-while enjoyment, to say nothing of the opportunity of winning one of the substantial cash prizes awarded

Test Your Alertness and Win a Prize

POPULAR SCIENCE MONTHLY is awarding $1,000 in sixty-three cash prizes for the best answers submitted in the fascinating contest described on this page. The cash prizes will be distributed as follows:

First Prize	**$ 500**
Second Prize	**100**
Third Prize	**50**
10 Prizes, $10 each	**100**
50 Prizes, $5 each	**250**
Total Prizes	**$1,000**

each month to the winners in the Contest.

How observant are you? How alert? Are you quick to detect errors in your own work, or in other people's? Here's a chance to test yourself in a way you will find as interesting as any game you ever played.

The idea of the Contest is simple enough. Each month we print a picture of John and Mary Newlywed at work on some odd job about their home. Always they go at the job with much enthusiasm, but with little experience and mechanical knowledge to aid them. And so, they make plenty of mistakes, some of them quite obvious.

In the picture either John or Mary, or both of them, are doing or have done one or more things in the wrong way. In addition, the artist purposely has made a number of errors in drawing the picture. You are to see how many of these mistakes you can find, make a list of them, and send them, with your reasons, to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth avenue, New York.

One thousand dollars in sixty-three cash prizes will be awarded to the contestants who point out the largest number of mistakes of any kind, and who present their explanations of these errors in the clearest and most skilful way.

In this month's picture, as you can see, John and Mary have a guest in their home. Mary's baby nephew has come to visit them, and they are having their troubles. The baby has fallen downstairs twice so far. And while no serious harm has been done, the Newlyweds have decided to play safe and build a gate at the top step on the first floor landing. The picture shows them at work.

First read the rules of the Contest. Then examine the picture carefully. What is being done wrong by John and Mary, and why is it wrong? What has the artist drawn wrong?

As you discover the mistakes, list them neatly on paper with pen and ink or typewriter, including with each answer a brief explanation, and send your list in. Ask the members of your family and your friends to help you. They will enjoy playing the game with you. You can submit as many separate entries as you desire.

You have until July 30 to submit your entry. And when you have completed your entry, you will be eager to try your hand at another "What's Wrong" picture which will appear in next month's issue.

The Rules of the Contest—Follow Them Carefully

1. Each month, until further notice, POPULAR SCIENCE MONTHLY is printing a picture of John and Mary Newlywed doing some simple job about the home. Each picture shows John or Mary, or both, doing one or more things in the wrong way and, in addition, there are a number of deliberate mistakes by the artist in drawing the picture. You are to tell us what things are being done wrong and what things are drawn wrong in each picture, and why they are wrong.

2. POPULAR SCIENCE MONTHLY will award $1,000 each month in 63 cash prizes for the best answers giving the greatest number of mistakes in the picture. These cash prizes will be distributed as follows:

First Prize	$500
Second Prize	100
Third Prize	50
Next 10 Prizes, $10 each	100
Next 50 Prizes, $5 each	250
Total Cash Prizes each month	$1,000

3. Prizes will be awarded to those persons who point out the largest number of actual mistakes found in the picture and who present their explanations of the errors in the clearest and most skilful way. Actual mistakes shall be construed in all cases to mean mistakes appearing in the picture about which there can be no question in the opinion of the judges. In case of ties, the full amount of the prize will be given to each tying contestant.

4. Answers to each picture must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the picture appears. Thus, to insure consideration in this month's contest, answers to the picture in this month's issue, published June 10, must be mailed or delivered not later than July 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

5. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink, and on one side of the paper only. Each error must be listed separately and numbered. No changes or corrections will be allowed in any entry after submission, but any contestant may submit as many separate entries as he desires.

6. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

7. You pay nothing. Just prove your knowledge and observation. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at public libraries free of charge. Each contest is open to everybody, except employees of POPULAR SCIENCE MONTHLY and the Popular Science Institute of Standards and their families.

8. Officials of the Popular Science Institute of Standards will act as judges and their decisions will be final. Acceptance of these rules is an implied condition of each entry.

First Winners Next Month

IN NEXT month's issue will be announced the names of prize winners in the first of our monthly $1,000 Picture Contests, which appeared in the March number. The judges will award sixty-three cash prizes, totaling $1,000, to contestants who submitted the best answers for the first picture of the series. Winners in succeeding contests will be announced in later issues.

Also, watch for a new contest next month.

Wall Street—*An Amazing Machine*

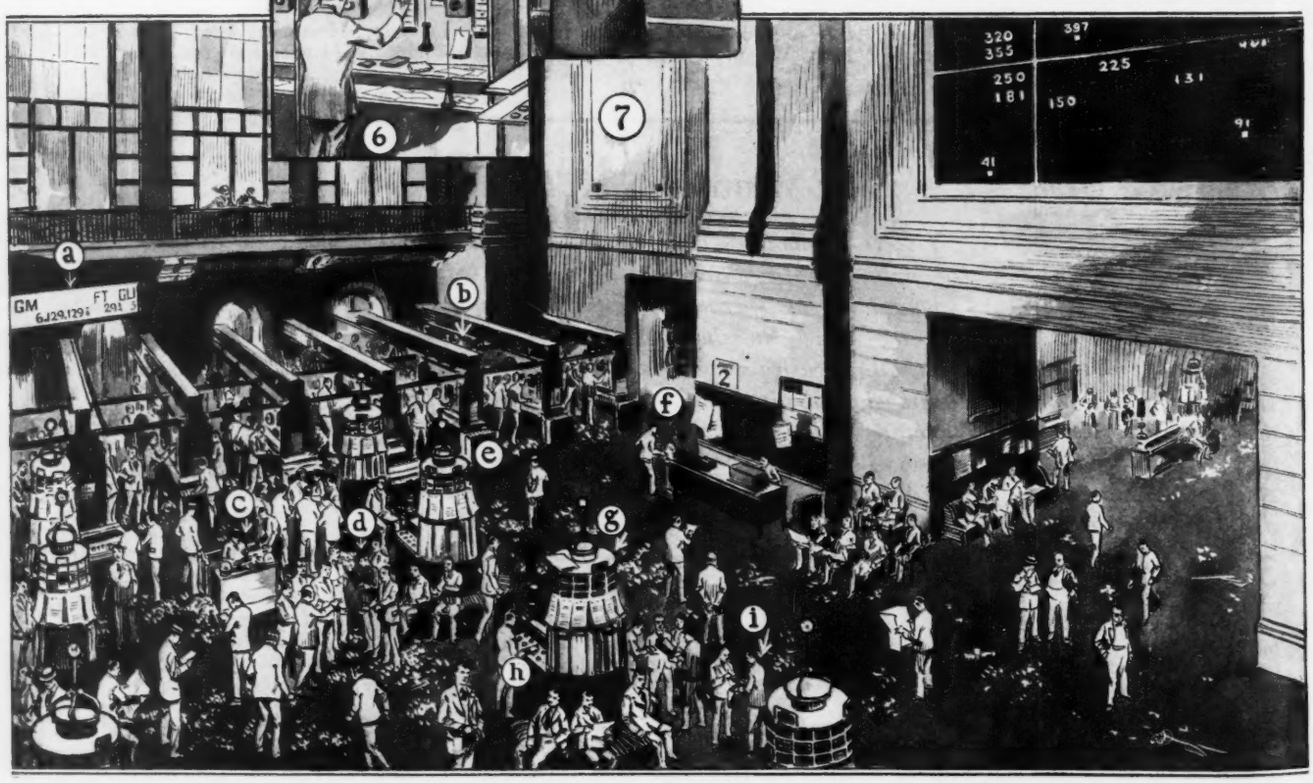
How Mechanical and Human Cogs Turn the Wheels

To left is shown an order form of the type regularly used by brokers. Note that time of receipt is very clearly stamped

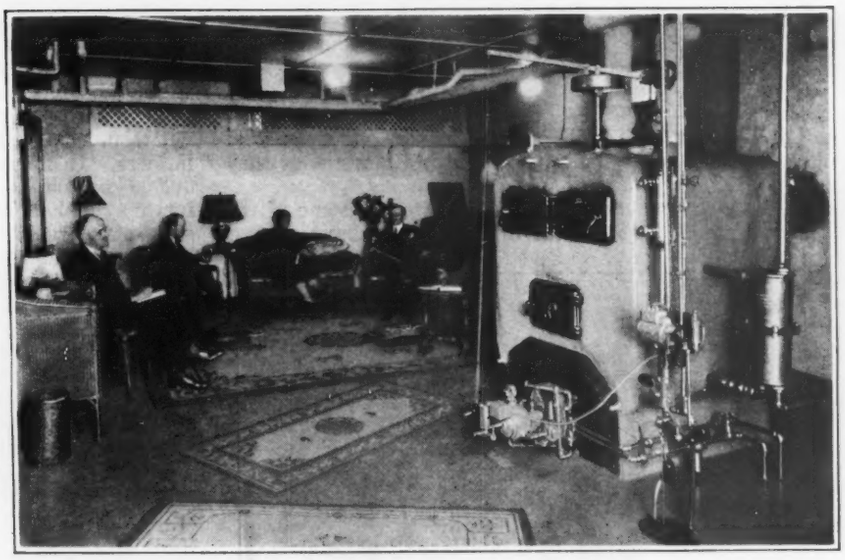
FEW laymen probably understand the intricate machinery of the stock market, or the amazing speed with which it operates. These pictures, which show the details of a typical transaction, present a comprehensive, understandable explanation of this wonder of our financial system. In a broker's office in San Francisco (1) a customer writes an order to buy 100 shares of stock at the market price, shown on the "trans-lux," a glorified stock ticker above his head. The broker passes the order to his telegraph operator (2) for immediate transmission to New York over his private wire (3). The order is received almost instantaneously in the telegraph room (4) at the office of a correspondent broker in New York, and the exact time of receipt is stamped upon it instantly

Below: (a) "trans-lux" ticker; (b) broker's booth; (c) ticker operator; (d) conducting a sale; (e) (g) trading posts; (f) call money desk; (h) messengers; (i) dealer in "odd lots"

"Tell-Tale" records time of order, avoiding dispute



The telegraph operator turns over the order immediately to an order clerk (5) who establishes telephone contact with the broker's booth (6) on the floor of the New York Stock Exchange (7) merely by pressing a button. When the clerk in the booth (b) receives the order, he signals the broker, who is on the floor of the exchange, by means of the electric annunciator board shown in upper right hand corner of picture. The broker purchases the stock required at one of the posts (g) on the exchange floor. Listed stocks are divided among twenty-nine such posts, about forty stocks to a post. Confirmation is transmitted by a reverse process back to San Francisco, the whole transaction often occupying no more than a minute



This comfortable living room in the home of Winfield T. Scott, of Passaic, N. J., now occupies the space that formerly was used for the coal and wood, before the installation of this oil-fired boiler seen in the foreground

SERVICE is the underlying policy of POPULAR SCIENCE MONTHLY. *This article, the first of an unusually informative series, carries out this policy. Mr. Fansler, associate editor of The Heating and Ventilating Magazine and secretary of public relations of the American Society of Heating and Ventilating Engineers, is one of the country's leading experts on house heating with oil fuel. His next article will appear in an early issue.*

What an Oil Burner Offers You

An expert answers the questions on cost, safety, and comfort that everybody wants to know before selecting and installing the new type of domestic heating equipment

By P. E. FANSLER

DOMESTIC oil burners are more discussed throughout the United States today than any other contributor to home comfort. Approximately 120,000 homes in which coal was used last winter will be heated with oil this year. Thousands of people are wondering just what an oil burner is; what it will do and what it will not do.

Intensifying this interest are recent coal shortages and the normal wholesome American demand for modern comfort and convenience in the home. To supply the demand, there have been developed oil burners that will give "heating comfort" in any type of heating apparatus, in a house of any size, anywhere in the United States.

The chief advantage of an oil burner is, of course, its convenience. The labor connected with its operation is infinitesimal as compared with that with a coal-fired plant, which requires attention at least twice daily. When you burn twelve tons of coal a year, you shovel about 150 pounds of coal a day in the coldest parts of the winter. With an oil burner, an almost superhuman thermostat feeds heat to your home as required. And the thermostat will obtain a more uniform temperature from an oil-burning plant than it can from a coal-fired system.

Many of the people who already have oil-burning equipment in their homes give as their chief reason for the change the increased cleanliness. The fuel is stored in a tight steel tank, usually outside the house, and is piped to the burner and consumed with practically no residue. The dirty, disagreeable job of ash removal is entirely dispensed with. A Chicago woman who has had an oil burner in her home for five years told me recently that it was installed so that her husband might have his winter Saturday afternoons to himself. Previously he had spent them sifting ashes.

The elimination of the dust and dirt necessarily results in improved health for the family. And so, too, does the marvelous uniformity of temperature that is possible only with fluid fuels. It is true, of course, that an increasing number of coal-fired plants are thermostatically controlled, but in producing uniformity of temperature they compare with oil plants about as the old "one-lung" horseless carriage compares with the eight-cylinder car of today.

Usually thermostats, simple yet wonderful little instruments, are set to hold within the limits of two degrees. This means, for example, that, if you set your thermostat at 68°, the burner will be started when the room cools to 67° and shut off when it heats up to 69°. Such uniformity of temperature, according to physicians, will do much to eliminate colds and other winter ailments.

VERY recently there has been developed for oil-burner regulation what is known as a two-period thermostat. This device holds the temperature at any desired point during the day, lowers it a specified number of degrees at night, and increases the heat early in the morning to insure comfort at rising time.

Many people who have oil burners tell me that the first cost of their equipment has been

Advice on Oil Burners

THE services of the Popular Science Institute of Standards are available to all readers of POPULAR SCIENCE MONTHLY.

To determine the efficiency of the several burners under actual working conditions, the Institute has undertaken, in conjunction with The Heating and Ventilating Magazine, a nation-wide survey of homes in which oil burners have been installed.

This survey is, perhaps, the most elaborate of its kind ever made. Burners in homes in every section of the United States are being inspected by engineers and reports are being compiled on the satisfaction given individuals by the different makes.

For information about oil-burning equipment for your home, address: Popular Science Institute of Standards, 250 Fourth Avenue, New York City.

returned in added usable space. Hundreds of coal bins have been turned into billiard rooms. And in other homes the accumulation of dirt and junk that cluttered the cellar has given way to children's playrooms. In one place, a coal bin was turned into a dining room.

I have been asked repeatedly if an oil burner is safe for a small home. Properly installed, the fire risk with a modern oil plant is so small that for practical purposes it can be disregarded altogether. A burner "listed" by the Underwriters' Laboratories, and installed according to the regulations of the National Board of Fire Underwriters, involves less risk than the average coal-fired plant.

AND as greater care is used in the installation of burners, the fire risk is rapidly declining toward the vanishing point. To this end the Underwriters recommend that only employees of burner manufacturers or men trained by them be permitted to install oil-burning equipment. With such men you can be sure that your flues and chimneys are properly cleaned and your pipe lines tested.

The Underwriters' Laboratories have tested a large number of burners and have "listed" about forty of them. But this "listing" in no way testifies to the efficiency of the burner. It means merely that in thorough laboratory tests the burner has met a standard of safety; that a study of its operation, design, construction and materials shows that it is as reasonably safe as human ingenuity and careful factory fabrication and inspection can make it.

As a further protection for the readers of POPULAR SCIENCE MONTHLY, burners listed by the Underwriters' Laboratories are tested in the laboratories of the Popular Science Institute of Standards to determine their combustion efficiency, and in addition a nation-wide survey of existing installations is being made to determine the efficiency of operation in actual usage. Approval of a burner by the Institute means that it does efficiently and satisfactorily the work it is designed to do; that it is sold at a fair price, and that the manufacturer maintains service and installation facilities that insure satisfaction.

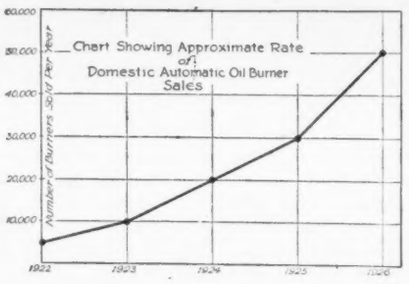
PERHAPS the question I have heard most frequently is, "What is the best oil burner?" Unfortunately, there is no best burner. There are many good ones and some poor ones. But, like radio sets, some give a larger degree of satisfaction under certain circumstances than under others. Much depends on the size of the house to be heated, its type of heating equipment and other factors. Much depends upon your particular ideas of what constitutes "satisfaction." What is a good oil burner for your next door neighbor is not always a good one for you.

Each home offers a specific problem—a problem that the Popular Science Institute of Standards can help you to solve. But in writing for advice it is well to remember that no oil-burner expert can offer worth-while advice without complete details as to your heating system, the size of the house, the type of construction, and the size and disposition of radiators.

Early in the development of the automatic oil burner, the noise of operation was a distinct disadvantage. However, today, after a period of refinement, many mechanical draft burners may be called almost noiseless. "Atmospheric draft burners," those depending upon the natural draft of the chimney, get away from the hum of motors and blowers, as they do not have these elements.

Some of these, as well as some of the mechanical draft burners, have proved

During cold weather, a man shovels daily his own weight in coal into the furnace



In less than five years, the number of oil burners in use throughout the country has increased from 5,000 to more than 200,000

very inefficient, and others have been brought to a high degree of perfection. I recently tested an atmospheric burner and found it so quiet that, with my ear against the boiler shell, I could not tell from the sound whether or not the burner was in operation. Over two periods of more than a month each, the boiler doors were not even opened.

People have asked me about the odors from oil burners. Given tight oil lines connecting the storage tank and the burner, there should be no smell. The cause of smells is the same as the cause of fires—leakage of oil, usually outside of the furnace. In improperly cut threads on the pipe lines or other careless installation lie the greatest dangers from oil burners.

Oil burners now are adaptable to practically every kind of heating plant, warm air, steam, water, or vapor. They will operate efficiently in a kitchen range, a small furnace or boiler, or the huge boilers under the largest apartment houses and office buildings. Thousands of California bungalows of five and six rooms are heated with oil, as are the Woolworth building and the Singer building in New York City. No matter what the size of your home, there is an oil burner that will fit it and give you what you want.

A few years ago, oil for domestic heating could be obtained only in a few districts outside of the oil-producing areas. Today, hardly a city of consequence is not served with oil suitable for domestic burners. In many cities of 20,000 and 30,000 population, several kinds of oil fuel may be had, at prices ranging from six cents a gallon to eleven cents. This latter price should include the delivery to any home within reasonable distance.

The initial cost of oil burners varies just as the prices of automobiles and radio sets vary. Small burners of the atmospheric or so-called gravity type, controlled by hand, can be installed for less than one hundred dollars. Such burners are, at best, but makeshifts, and yet today there are many of them in actual use, and extensive investigations indicate that even with their disadvantages the average owner would not revert to the use of coal. Better burners of the same type range in price up to about $250, and should prove thoroughly satisfactory to the owner of a small home who is not too exacting.

YOU can select mechanical draft oil burners to suit your needs and tastes at prices ranging from around $350 to about $1,000. The higher-priced ones of course are more carefully built, of the highest class materials; and the price includes larger fuel tanks and more refinements and conveniences than the lower-priced ones. Examples of such burners have records of several years of use without a single service call.

When a man asks me to compare the operation costs of an oil burner with those of a coal-fired plant, I tell him that it can't be done. Coal is hand-fired with much labor and dirt. If you pay a "furnace man," you should include his wage as part of your heating bill.

Even with a hired man to tend the furnace and a thermostat to control a coal fire, you cannot get the same "heating comfort" that you can with a good oil burner. Consequently, you cannot compare costs. In different localities the cost of a ton of coal may be greater or less than the cost of a quantity of oil containing the same amount of heat, but this ratio of costs is not a comparison of results obtained.

FUEL costs with coal depend much on the intelligence with which the firing is done. You may use fifteen tons of coal a year. Your neighbor with an identical house may use twelve tons, or eighteen tons. But with thermostatically regulated oil burners, the fuel bills in the two houses should differ very little.

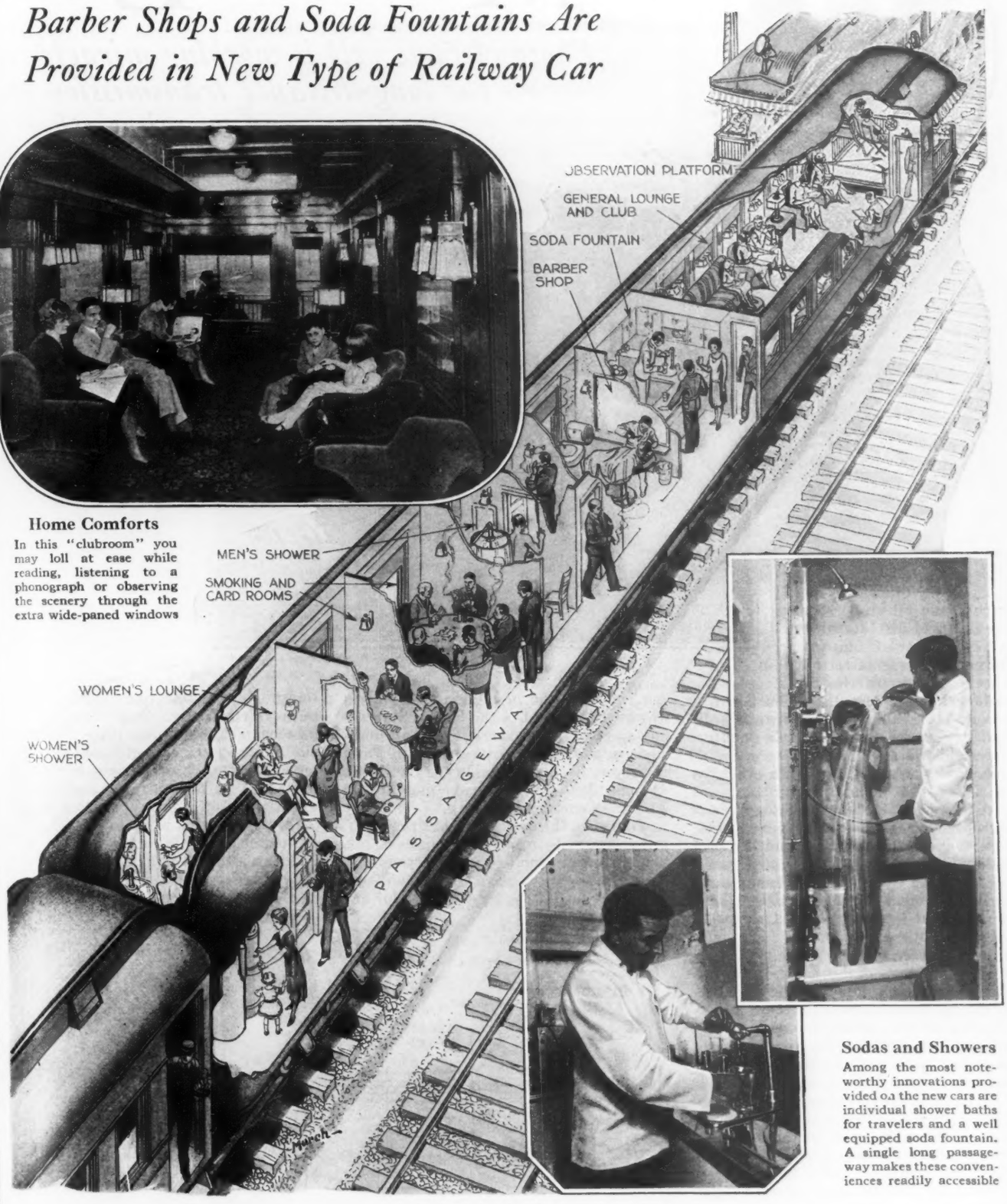
Even in cases where the oil burner is more costly to operate than the coal plant, you are getting ample return in increased comfort and convenience. Various men who have burned oil in their homes for periods of from two to six years have told me they would not go back to coal even if oil cost from twenty to 100 percent more than coal. In a county in Illinois noted for its coal production, where coal can be bought for about the cost of mining it, a larger number of people have installed oil burners in proportion to the population than in sections hundreds of miles from coal mines.

A Luxurious Hotel on Wheels

Barber Shops and Soda Fountains Are Provided in New Type of Railway Car

Home Comforts

In this "clubroom" you may loll at ease while reading, listening to a phonograph or observing the scenery through the extra wide-paned windows



Sodas and Showers

Among the most noteworthy innovations provided on the new cars are individual shower baths for travelers and a well equipped soda fountain. A single long passageway makes these conveniences readily accessible

THIS new type of railway car provides all the luxuries of the modern hotel for the traveler by rail. Within a total length of eighty-three feet, these remarkable cars, ten of which have been built for the Northern Pacific, provide lounge rooms, card rooms, shower baths for both men and women, a fully equipped soft drink parlor, a barber shop, valet service and observation platform.

Startling innovations in railway car design were necessary to provide space for so many luxuries. Ordinary car doors and steps have been eliminated. The only entrance to the car is by way of the Pullman to which it is coupled. The space ordinarily used for vestibules is put to other service. The shower baths are supplied by an air-pressure water system with tanks of 350 gallons capacity.

Great pains have been taken to get rid of any similarity in appearance to ordinary chair cars. The seats in the lounge rooms and all of the decorations are individual in design. Each lounge contains a phonograph, library and other comforts.

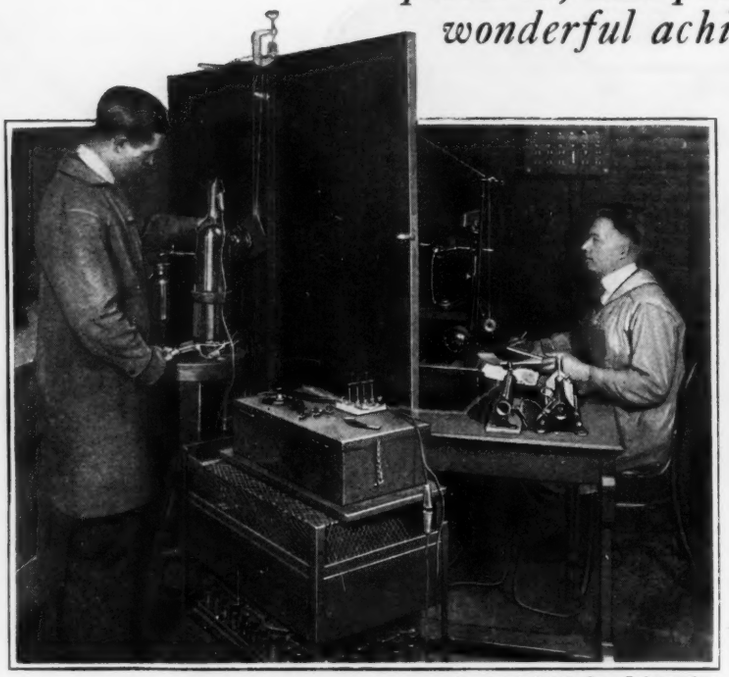
And for a final touch of luxury, a powerful electric searchlight has been fitted over the observation platform, making sight-seeing possible at night.

A New Marvel

This little glass tube, the photo-electric cell, is one of the marvels of the twentieth century. It makes possible long-distance transmission of pictures. At the right: Research engineers of the Bell Telephone Laboratories in New York City, A. R. Olpin and A. L. Johnsrud. They are seen experimenting with one of the latest types of photo-electric cells

The MAGIC EYE

Photo-electric cell is working miracles in the long-distance transmission of pictures, and promises other wonderful achievements



Courtesy Bell Telephone Laboratories

A MAN walked into the offices of the Marconi Wireless Telegraph Company in London the other day, and there made out his personal check for $1,000, drawn on a New York trust company. Twenty minutes later that check, having traveled by radio across the Atlantic, was honored by a New York bank and deposited. Hardly had the ink dried on the man's signature before his business associates some 2500 miles away were looking at an exact duplicate of what he had just written!

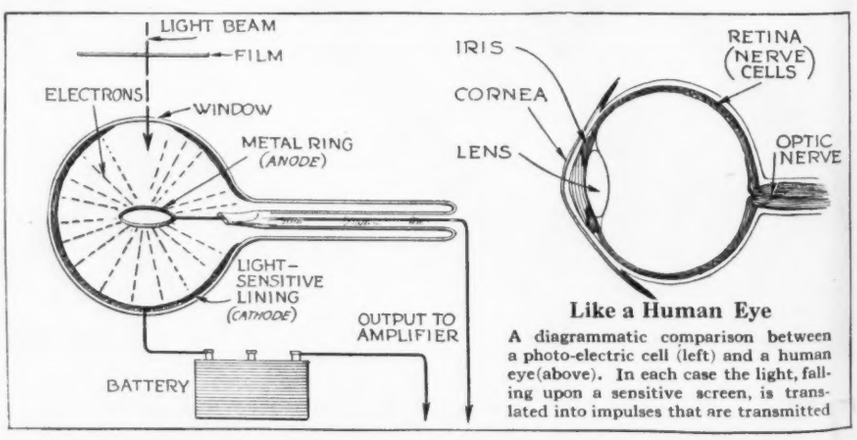
A few days afterward, photographs of European events and personages—a horse race at Newmarket in England, Premier Baldwin on his way to a strike conference, the Prince of Wales at Biarritz, and news pictures of the British general strike—were flashed over the sea and published in American newspapers a few hours after they were taken.

These incidents of the recent opening of the world's first commercial trans-Atlantic picture service were hailed not only as remarkable new achievements in swift communication, but as marking one more important step toward the fascinating goal of television, or sight at a distance.

Little by little we are approaching this crowning marvel of communication. Each year our eyes are seeing farther and farther. Through the magic glasses of electricity, by wire and radio, far-off faces, scenes and pictures are being brought almost instantaneously within our range of vision. Before many years, we are told, it may be possible for us to sit in the theater or in our homes and "look in" on distant events as they are enacted, just as we now "listen in" with our radios to distant voices and music. Perhaps, even, when we answer the telephone, we may see the person at the other end of the line while we talk with him. Indeed, from Edouard Belin, the noted French inventor, we have the prediction that "when the next President of the United States is inaugurated three years hence, an audience in a moving picture show in Paris will watch the ceremony exactly as though they were present—and at the precise moment it is going on."

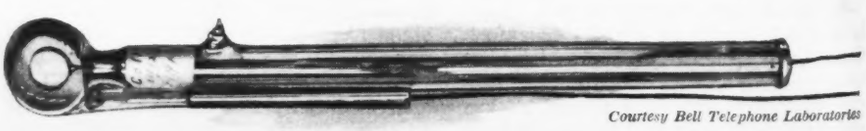
That such things are credible, that they are accepted today as possibilities of the near future, is due to the perfection of a little glass instrument no larger than your hand, yet one of the most wonderful devices ever conceived. It is the photo-electric cell; an electrical "eye" so keen that it is almost as sensitive to light as the marvelous mechanism of the human eye, of which it is a copy.

THE real secret which enables this little instrument to perform its marvels, however, lies in its ability to translate variations of light into corresponding variations of electric current. This is the property which has made it possible not only to send pictures and writing over long distances by radio and wire, but to perform intricate and astonishing new scientific calculations in terms of electricity. Only the other day, for example, a photo-electric cell was employed by Professor Joel Stebbins, director of the Washburn Observatory of the University of Wisconsin, to measure and weigh stars so far distant that their light takes hundreds of years to reach us! In like manner, as told in the April issue of POPULAR SCIENCE MONTHLY, the same little glass tube enabled Bengt Stroemgren, the sixteen-year-old scientific wizard



Like a Human Eye

A diagrammatic comparison between a photo-electric cell (left) and a human eye (above). In each case the light, falling upon a sensitive screen, is translated into impulses that are transmitted

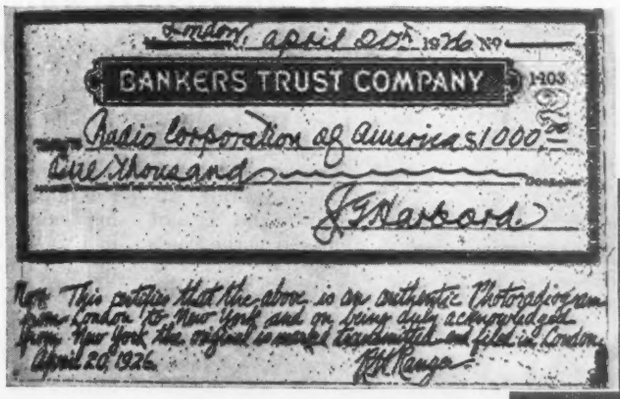


Courtesy Bell Telephone Laboratories

Another form of the photo-electric cell with glass bulb broken away to show the interior construction. The connecting wires may be compared with the optic nerve in the human eye

that SEES *across the* OCEAN

By H. C. Davis


BANKERS TRUST COMPANY
1103
Radio Corporation of America $1000
One Thousand
J. Harbord
Note: This proves that the above is an authentic Photograph sent from London to New York and on being duly acknowledged from New York the original is marked transmitted and filed in London.
April 20 1926
H. H. Ranger

Across in Twenty Minutes

This check was sent from London to New York in twenty minutes. Below: Captain R. H. Ranger of the Radio Corporation of America, inventor of radio picture apparatus, receiving a transmitted photograph

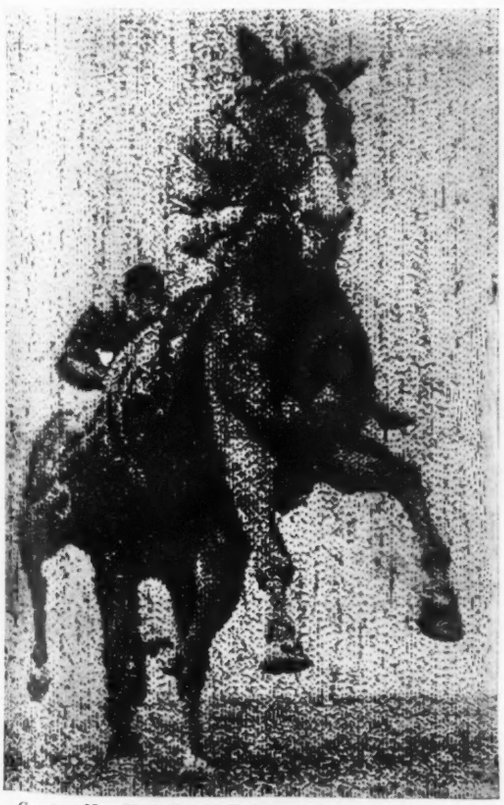
of Denmark, automatically to register the movements of the stars.

Its possibilities are alluring. Any day this little organ of "electrical vision" may reveal to us unfathomed mysteries of far-distant suns and planets.

Perhaps a comparison with the human eye will give the best idea of how amazingly the photo-electric cell has been made to record what it "sees" through miles of space. As you look at this page, for example, the lens of each of your eyes, like the lens of a camera, is throwing an image of everything within its range on the sensitive screen called the retina. This living screen is made up of countless tiny nerve cells, forming a mosaic of minute points. Each of these points is highly sensitive to the electromagnetic waves which we call light; so that any one of them, when light is focused upon it, is immediately stirred to activity. Each cell, too, is connected with the brain by a nerve fiber—a little line of communication which instantly transmits the impression and records it on the brain.

THUS, when the image of this page is thrown on the retina, it is divided up into thousands of tiny patches of light, shadow, and color, recorded separately yet all combining to form a complete and perfect picture in the brain. So packed together are the cells of the retina that it has been estimated there are at least fifty million to the square inch. Every time you look at the moon, about a thousand of them are responding to its light and recording its image. When you look at a man's face at a distance of about twenty feet, it takes about ten thousand of them to record the face on your brain.

Now the photo-electric cell is like any one of these tiny cells of the human eye. Highly sensitive to light, when struck by waves of light it is aroused instantly to activity. Like the human cell, there are attached to it little wires of communication which, through the medium of an electric current, carry a record of the impression it receives. In short, the photo-electric cell simply translates the light impulses it receives into electrical impulses. The latter travel along wires or through the ether and are recorded on an electrical "brain," or receiving apparatus, in such a way that they can be translated back into visible images of light and shadow.



Courtesy New York Herald Tribune

A Horse Race by Long Distance

Photo of horse race at Newmarket track, England, flashed by radio across the sea and printed on this side of the ocean just a few hours after the photograph was taken

THERE is one important difference, however, between this wonderful electrical eye and the human eye. Where the latter has millions of cells to make an instantaneous record of all the pin-point patches of light composing a complete image, the former has only a single cell to do the work. In picture transmission this single cell, however, has been made to accomplish the purpose in a most ingenious way. Since it cannot see and record a picture as a whole, it does the next best thing. It scans the picture a patch at a time, recording each portion separately, until the entire picture is completed. It is as if you were to read this page, letter by letter, until the entire page with its words, sentences and paragraphs were recorded in your mind.

Examine for a moment a typical photo-electric cell. Here is a small glass tube with a bulb at one end, somewhat resembling the tubes in your radio set. On the inside surface of the bulb is a thin coating of potassium or similar material sensitive to light, and from this coating a sealed-in wire runs to the outside of the bulb. In the center of the bulb, and separated from the sensitive element, is a ring of non-sensitive metal—platinum or nickel—and from this a second wire runs out through the stem of the tube. The two wires are connected through a battery which constantly applies electrical pressure to them, and through an amplifier which in turn is connected with relays that operate special telegraphic sending apparatus. At one point on the bulb is a little window through which light can be admitted.

NOW see how it works to translate the lights and shadows of a picture into electrical impulses that can be transmitted. Around the surface of a glass cylinder is placed a film bearing the image or picture to be sent. On the film a sharp pencil point of light is cast. As the cylinder slowly revolves, the narrow beam of light passes swiftly across the film, in a succession of thin, parallel lines. Every time it strikes a dark patch, the beam of light is cut off, while the light portions allow it to shine through.

By an arrangement of lenses and reflectors, the light which passes through the film is focused on the little window of the photo-electric cell. What the electrical eye "sees," then, as the beam passes across the film, is a rapid succession of lights and (*Continued on page* 113)

Does Your Pen *Reveal*

You Can Tell What a Man Really Is Say Graphologists—How They Read

By WILLIAM J. WHITE, JR.

In the following article, an able reporter presents the results of a careful investigation of the secrets by which graphologists claim they can read a man's character in his handwriting. This art, while generally discredited by scientists, always has been a source of much interest and entertainment. You will enjoy trying out the methods which Mr. White explains here.

IN ONE of the great structures that bear down upon the end of Manhattan Island, seemingly intent upon forcing it beneath the surface of the surrounding waters, is the suite of offices of a financier who is at once the envy and admiration of all with whom he comes in contact.

His business is not large; in fact, he seems to discourage any great growth, preferring to keep it well under his personal supervision. But it is extremely profitable. The continual source of amazement to his associates is not so much his success—there are hundreds of men down-town with equally large incomes, and many with larger. Rather, it is his uncanny ability in passing judgment upon the integrity of strangers with whom he does business.

IN A great city like New York, and particularly in that section known throughout the world as Wall street, there are at work sharpers who seek to profit from the ignorance and credulity of others. This man's business is of a nature that he comes in contact with many of that breed. Movies to the contrary, these deceivers are not easily recognizable. Were judgment made on appearance alone, many an honest man would have been ordered unceremoniously to leave while the trickster was being presented with the combination to the safe.

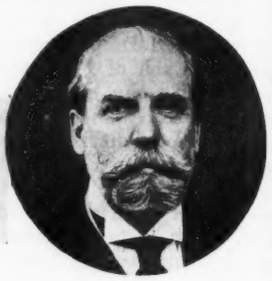
And yet this business man seems always to pick them right. His friends know that in many of his deals there isn't time to look up the family history of a casual business acquaintance. How then, they ask, does he avoid being bitten occasionally? And, receiving no answer, they ascribe his success either to luck or intuition.

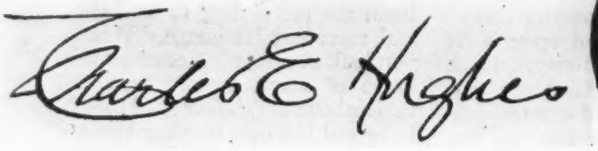
His secret is known to only two men—himself and Robert R. Ross. The latter's name is not on the pay roll; it is doubtful if any of the clerks outside of the financier's private secretary has ever heard of him. His yearly retainer is paid from the financier's private checking account, and is not entered on the firm's books.

Ross is a "graphologist," a specialist in determining a person's character from his handwriting. At intervals his client visits him and submits a bank check or a sheet of paper bearing a specimen of handwriting. Ross analyzes it, gives his opinion of the character of the writer. The client leaves, and in a day or two his friends have something new to wonder about. He has "guessed" right again.

Such is one man's faith in graphology. I could mention many other cases quite similar. It is pretty generally known that many business firms make use of the services of professional graphologists in selecting their employees. What, then, is there in this so-called science to warrant such implicit confidence?

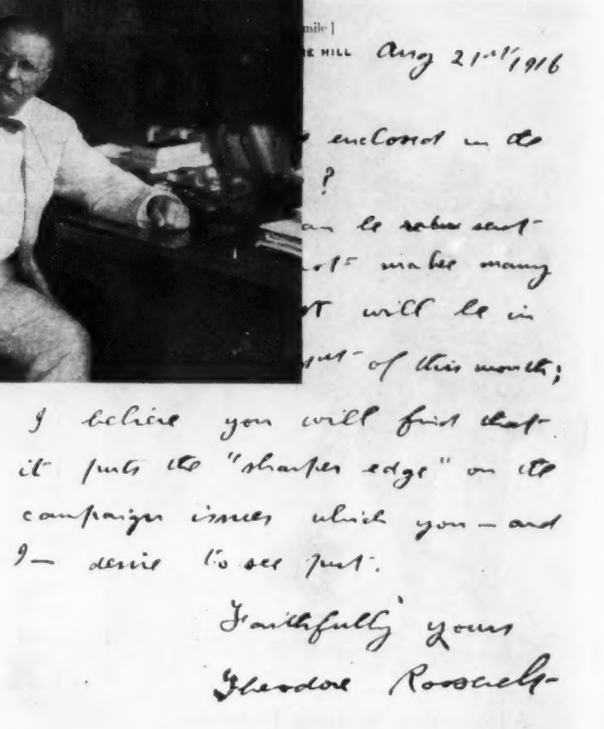
I discovered that there is little of the occult about graphology. Its proponents assert it to be an exact science, based upon common sense and observation. Its possibilities for analyzing character are believed to have been discovered by an Italian named Baldo in the early part of the seventeenth century. From that time to the present it has undergone many changes; old ideas have been cast aside and new ones substituted, until today its supporters, though disagreeing with





Resembling a hastily written figure 8, the small *g* in the signature of the former Secretary of State reveals to the graphologist acuteness of mind and keen perception. The decreasing size of the small letters toward the end of each word denotes tact, while the angularity of the strokes shows strong affections. Shrewdness and reserve are indicated by the wedge-shaped writing

Theodore Roosevelt wrote a simple hand, without pretense or show. The capitals are plain. This is interpreted by graphologists as a sign of an insistent nature. Every movement of his pen, they assert, denoted quickness, animation and much hastiness, modified by love of ease, as well as high integrity and honor. His down strokes were shaded. Quite obviously they were not made for effect, but bespoke characteristic enthusiasm and energy



Aug 21st 1916

enclosed in the

?

can be taken care-

not make many

it will be in

part of this month;

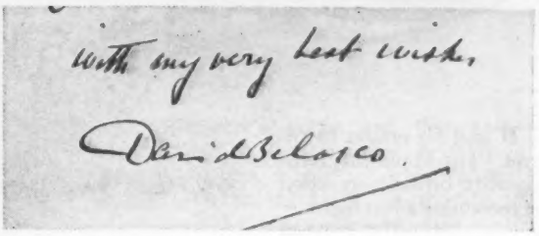
I believe you will find that it puts the "sharper edge" on the campaign issues which you — and I — desire to see put.

Faithfully yours

Theodore Roosevelt

Your Character?

from the Way He Crosses His t's, *Secrets in Handwriting Quirks*



The handwriting of this famous theatrical producer is called an excellent example of the combination intuitive and deductive reasoner—a characteristic indicated by the separation of letters in several of the words, and the hooking up of the small *d* with the capital *B* in the signature. The sharpness of the strokes is said to indicate acuteness of perception, while the simple, dignified capitals show high artistic taste. The general impression of speed tells of incisiveness. Graphologists, generally, are of the opinion that this writing is full of character

regard to a few minor details, are in general agreement regarding the meaning of various types of handwriting and are sincere in their convictions that the deductions they make are accurate.

Shortly before Richard E. Enright retired as police commissioner of New York City, a midnight conference was held at headquarters, attended by the commissioner, one of his deputies, Joseph A. Faurot, and Dr. Albert J. Smith, well-known grapho-psychologist of Brooklyn, to whom I am indebted for many of the analyses on these pages. The purpose was the attempted solution, by means of graphology, of a baffling double murder.

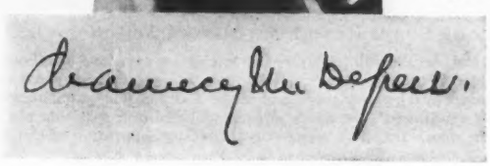
BRIEFLY, the circumstances were as follows: A socially prominent man and a woman were found slain, revealing the fact that both had been leading double lives, since each was married. Suspicion pointed toward the man's wife, but the police had not a single clew worthy of the name to work on. At the time Dr. Smith was called in, the search for the murderer was about to be discontinued as hopeless.

Four letters, identical in text, were given to Dr. Smith for analysis. One was written by the woman under suspicion, the others were copied by persons known to the commissioner.

"Which of these writers is capable of committing such a crime?" the commissioner asked Dr. Smith, who, after a careful examination of the four specimens, finally selected one.

"Here's the person you want," he announced.

The commissioner and his deputy gasped. Dr. Smith had picked the letter written by the murdered man's wife! On the basis of that deduction, the police renewed their efforts to pin the crime on the woman, although as yet they have failed to secure sufficient evidence to warrant her indictment.



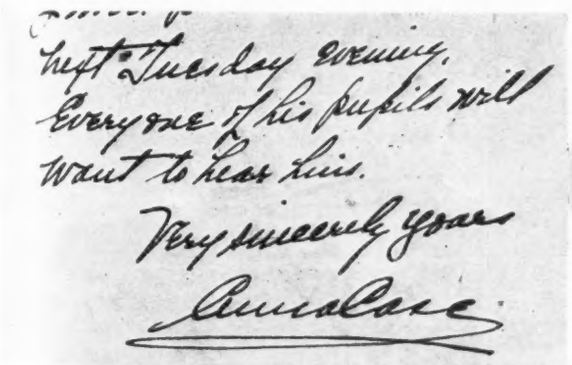
Mr. Depew's small letters are sharp, indicating lucidity and sound reasoning. His genial nature is said to be betrayed by the *u*, *n*, *w*, and capital *M*, all of which are formed in much the same way. This formation, say the graphologists, is always a sign of an affable and friendly disposition. The long stroke of the *p* also indicates aggressiveness

The graphologist starts out with the basic idea that there is a reason back of every move made by the pen. Most of their theories are easy to follow. Say, for example, that the writing is small and neat in appearance. One would expect the writer to be neat in his habits as well. The small size of the letters, graphologists say, implies concentration and attention to detail. And, reversing the process, graphologists reason that one who writes with large characters is inclined to generalize, and dislikes detail.

In analyzing a piece of handwriting, the graphologist considers these points first: The size of the writing; the slope; the shape of the individual letters, including a comparison of the height of capitals and small letters; the thickness of the strokes; the space between the individual letters and the space between words; margins; connections; finals, that is, the word endings; flourishes, and the amount of deviation, either up or down, in a line of writing from the normal horizontal.

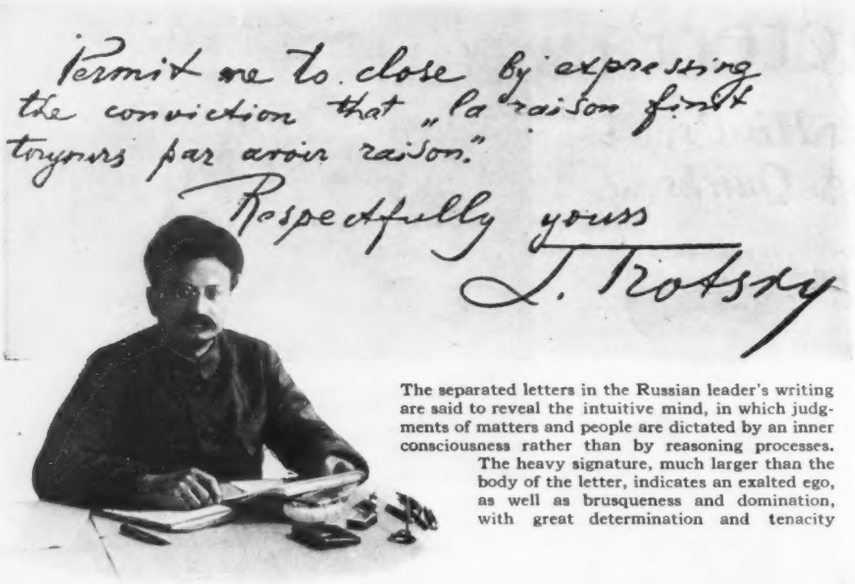
SO SERIOUSLY does the graphologist regard punctuation that he puts it in a class by itself. This includes the crossing of the *t*'s, the dotting of the *i*'s and *j*'s, the commas, periods, colons, etc. By far the most important of these is the *t* crossing. Many exponents profess to be able to give a fairly accurate reading of a subject's character from an examination of the *t*'s alone, but on the whole they advise that the entire specimen be carefully examined before any judgment is passed. It would be as unfair, they say, to condemn a writer because of one bad attribute cropping up occasionally as to form a fixed opinion of a stranger's irritability simply after overhearing a word or two spoken in anger.

It was almost on the strength of the punctuation alone that Dr. Smith made an analysis involving the loan of several thousands of dollars by a bank on an unsecured note. The integrity shown in other parts of the hand was attested to by careful punctuation. The bank took a chance on Dr. Smith's say-so.



Anna Case

There is a rhythmic swing to the noted singer's pen which, the graphologist declares, evidences an inherent love of music. The writing has a decided upward slant, denoting high ideals and ambition. It is shaded but not smeary, indicating that the writer is fond of the beautiful and artistic in all things. The self-confidence warranted by Miss Case's achievements is found in the graceful flourish of the signature shown in the reproduction of one of her letters


Permit me to close by expressing
the conviction that „la raison finit
toujours par avoir raison."
Respectfully yours
L. Trotsky

The separated letters in the Russian leader's writing are said to reveal the intuitive mind, in which judgments of matters and people are dictated by an inner consciousness rather than by reasoning processes. The heavy signature, much larger than the body of the letter, indicates an exalted ego, as well as brusqueness and domination, with great determination and tenacity

It had no reason to regret. The applicant, temporarily broke, succeeded in recouping a lost fortune, which, naturally, reacted to the benefit of the bank that had assumed the risk.

The size of a correspondent's hand might be likened to the same person's gesturing in conversation. The airy talker waves his hands and deals in generalities. It's pretty difficult to pin him down to minute items or specific facts.

"Oh, let's not bother about picayune details," you can hear him say. That same sweep of the hand is revealed in his writing. Bold capitals, flowing script. But the conscientious person is more careful of his facts—less inclined to be carried away by his own enthusiasm. He weighs each point carefully. In talking, he is niggardly with gestures; when he uses them at all, he makes them count. And his handwriting displays the same conservatism; the same desire to make each stroke tell. The letters are smaller, more carefully made.

THAT is the general graphological interpretation of size. Of course, it is modified by other attributes which the trained man takes in as he follows the words.

The slope of the writing is supposed to be an index of the affections. The graphologist regards a seventy-degree slope to the right as about normal; that possessed by one of a kindly, loving, generous disposition. Further to the right shows an excess of emotion. The more it tends to vertical the colder and the more calculating will the subject be, until the disagreeable, heartless nature is reached in the backhand.

But here, more than any place else, the warning is given not to be too hasty in judgment. Frequently, it is said, a person will write a backhand due to suppressed emotions which are not permitted any outlet. A disappointment in love may, we are told, change the hand to a backward slant.

Some schools teach backhand, and one who has learned the system may go through life studiously holding himself to that style, especially when he is writing something that will be viewed by others. That illustrates a point graphologists are insistent upon: that the writing be spontaneous and unstudied, preferably set down when the writer is so full of his subject that he will be concerned solely with the idea of getting it down on paper.

Again, it is said, backhand writing may reveal so many of the kindly characteristics that its effect is more than offset. But, when combined with undesirable traits, graphologists agree that it is the badge of utter coldness of heart.

Rounded letters—you naturally think of them as "babyish"—signify the indolent person, one of little character. The writing has a decidedly unhurried look about it, and should not be confused, we are warned, with circular swinging letters that disclose a sense of rhythm. Sharply formed letters—to the point, as it were—are made by the incisive writer. They seem fairly to scream: "I have something to say and I want to be quick about it!" The person of acute perception, graphologists tell us, will have that angularity of hand.

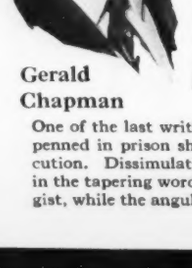
THE higher the capitals, speaking generally, the greater the writer's appreciation of himself. There are other signs of self-esteem, but they will be taken up later. A writer is further incriminated if there are many flourishes appended to the large letters. Capitals that scarcely peep above the small letters are employed by the too modest man. He, we are told, will never make a good executive, lacking the self-confidence so essential for such a post.

Vigor, passion, sensuousness and sensuality, or their lack, are read in the thickness of the down strokes of the pen. These range from the thin, ethereal lines of the sensitive, spiritual nature to the broad, muddy splotches of the sensualist, gourmand or brute.

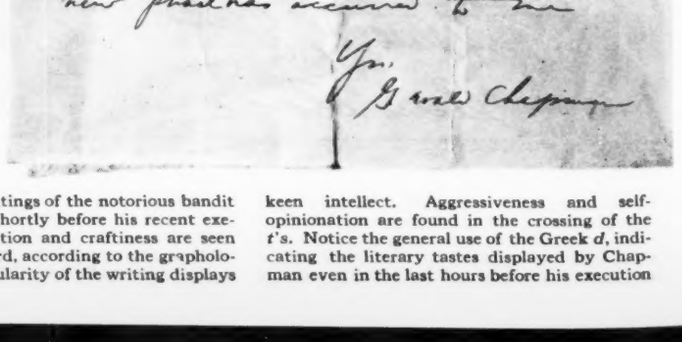
What could be more natural than the graphological reading of wide spacing between letters, words and lines as the desirable attribute of generosity? It seems reasonable enough, doesn't it, that a stingy person will crowd his letters together and start another word right on the heels of the one just finished, lest he be forced to use two sheets of paper where one might do? In the same way, the person fond of display, the man who in the old days of the pre-Volstead era would command, with an imperious sweep of the arm, that all in the place be served at his expense, will be so extravagant in his chirography that frequently only two or three words will occupy an entire line. In a hand that otherwise displays good attributes, graphologists may read (*Continued on page 121*)

Long Loops Reveal the Man of Action

This writing of the Arctic aviator and explorer illustrates the graphologist's assertion that physical activity is revealed by the length of the lower loops in handwriting. Notice particularly the depth of the *J* and *g*. Great enthusiasm is indicated by the shading of the down strokes. The simple capitals show an artistic side to the man. Intuitive sense is betrayed by separation of the letters

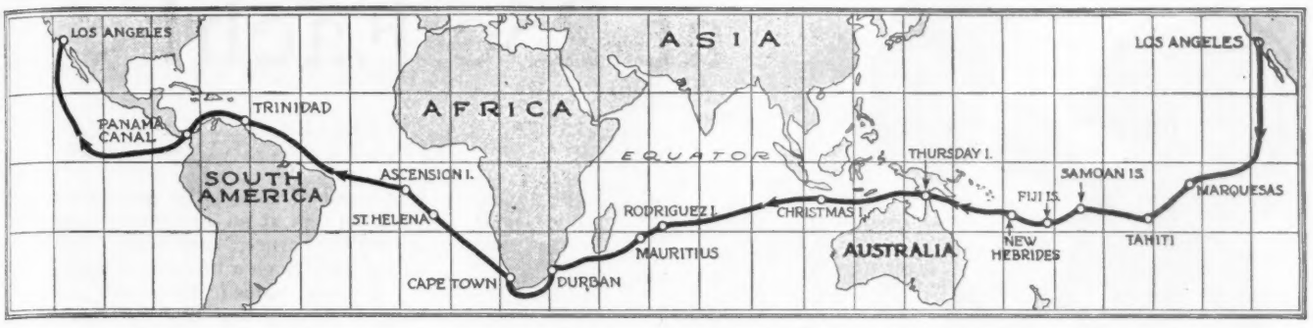


Gerald Chapman


I did not have opportunity
to state fully my opinion of
matter of under discussion, and
now that has occurred to me
Yr.
Gerald Chapman

One of the last writings of the notorious bandit penned in prison shortly before his recent execution. Dissimulation and craftiness are seen in the tapering word, according to the graphologist, while the angularity of the writing displays keen intellect. Aggressiveness and self-opinionation are found in the crossing of the *t*'s. Notice the general use of the Greek *d*, indicating the literary tastes displayed by Chapman even in the last hours before his execution

Around the World in a Yawl



Spectacular Feat of 52-Year-Old Los Angeles Man Who Sailed 35,000 Miles, Alone, in Small Homemade Craft

By G. B. SEYBOLD

A LEAN, tall man with bronzed skin, thick, gray hair and quizzical blue-gray eyes sat in the cabin of a little yawl anchored in Long Island Sound, near New York, a few days ago, and told me of one of the most spectacular feats on the high seas in this generation. As he talked, he pushed a big needle through stout canvas, repairing a mainsail. A handsome bronze medal presented to him the night before lay on a table nearby.

"Awarded to Harry Pidgeon," the inscription read, "who completed a voyage of 35,000 miles around the world, single handed, in the yawl *Islander*, thirty-four feet over all, taking three years, eleven months and thirteen days for the voyage." It was the coveted Blue Water Medal awarded for his remarkable exploit by the Cruising Club of America, and he had come from California to New York to get it.

TO TELL the full tale, the inscription should have said much more. It should have told how this man, who all alone had sailed around the world, had started out on his cruise when he was 52 years old, and in a small boat built by himself; how, a landlubber knowing nothing of the sea, he had learned navigation by reading in the public library. It might have pointed out, too, that only one other man in the world's history had performed a similar feat—Captain Joshua Slocum, in the nineties. But Captain Slocum was an experienced navigator; and his boat, the *Spray*, was larger, too, than the *Islander*.

"I had always wanted to see the South Sea Islands," Captain Pidgeon was saying. "I wasn't married, there wasn't any reason why I shouldn't go if I wanted to, so I went. When I started out, I didn't know I would get 'round the world, but I kept on going, stopping where I liked, and pretty soon it was closer to get home by going on than by turning 'round."

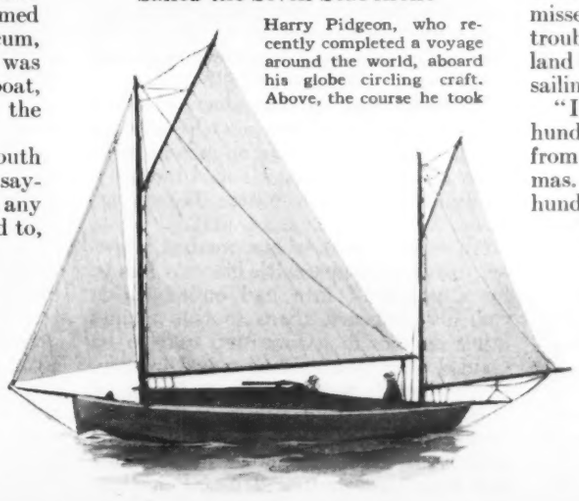
There was another reason for this extraordinary trip—love of adventure.

"I lived on a farm in Iowa until I was eighteen," he explained. "Then I decided to go to California. After a while I went to Alaska and British Columbia, and then came back to Iowa to see the folks. Being near the Mississippi, I built a house boat and went in it to the Gulf. Returning to California, I got a buckboard and a horse and drove to Mexico, then up the coast to Canada. Following a stay in the Sierra lumber camps, I got a farm in the San Joaquin valley."

But the wanderer was not contented. So on Mormon Island in Los Angeles harbor he began building a yawl, after plans which he found in a yachting magazine. For a year and a half he worked on it, doing almost everything himself.

Sailed the Seven Seas Alone

Harry Pidgeon, who recently completed a voyage around the world, aboard his globe circling craft. Above, the course he took



Harry Pidgeon's *Islander*, with full sail, the 34-foot homemade boat which covered 35,000 miles in nearly four years

"LIKE a hollow log," some described his five-ton, V-bottom boat of the sea bird class. The cabin ran nearly two thirds the length of the boat and served both for living quarters and a storeroom for provisions and water.

In this strange craft, christened the *Islander*, Harry Pidgeon sailed for Hawaii in 1920 and returned some months later, having proved triumphantly that his homemade boat was seaworthy.

A year later, on November 21, 1921, with three months' provisions and two sets of sails, he started for the South Sea Islands.

Terrific storms raged on the Pacific soon after he had left shore. These he missed miraculously, but he ran into trouble in the doldrums, the no man's land of the Pacific, a belt of terror for the sailing vessel.

"It took me two weeks to go five hundred miles," he said. "That kept me from reaching the Marquesas by Christmas. Ordinarily, I could make one hundred and twenty knots a day."

"How did you manage at night?" I asked.

"Oh, I shortened down the sails, lashed the rudder, and went to bed. The *Islander* made good time at night. One night she did over seventy miles. If there were squalls, I would wake up, trim, take down and reef the sail in ten minutes.

"Late in December, after forty-two days at sea, I woke at dawn and through a porthole saw Ua Huka

(*Continued on page 117*)

Old Patent Models at 25c Each!

By Edgar C. Wheeler

Thomas P. Robertson, Commissioner of Patents, inspecting some of 200,000 old patent models disposed of by the Patent Office as a result of changed policy

MAX COHEN stood beside his pushcart at the curb on Orchard street and called out his wares:

"Here they are. . . These famous inventions! . . . Thomas Edeeson! . . . Who wants inventions?"

It was a Saturday afternoon; and Saturday is the teeming day along this picturesque street on New York's East Side. Through the narrow way, hemmed by dingy brick tenements and basement shops, a tumbled mass of humanity moved sluggishly past a thousand pushcarts that hugged the spattered curb as far as the eye could see. Here, in endless succession, were spread to the open air and dust all the common necessities and luxuries—everything, from shoes and hammers and shirts to dolls and books and cheap jewelry.

"Who wants inventions?"

Elbowing my way through a crowd of men and boys that almost smothered Max Cohen and his little cart, I came upon a surprising sight. There, heaped helter-skelter on the rough floor of the cart, lay a pile of working models; patented creations of inventors for half a century past!

THEY were gray with dust and scarred by time. Most of them bore little tags telling the name of the inventor and the number and date of the patent.

At the front of the cart, and leaning against an "automatic burglar alarm," lay a little machine labeled, "Hydraulic Motor. William B. Cass, 1878;" a bewildering contrivance of wheels and cogs, levers and pulleys, all carved from wood with infinite patience. To complete it, perhaps, a struggling young inventor labored in some dark garret far into the night, month after month. Perhaps, to perfect his idea, he braved the pangs of hunger and carried on through poverty and discouragement. And perhaps, in the end, his rewards were only thwarted hopes and disappointment. Or did he eventually gain some degree of wealth and satisfaction? Who could tell?

A stocky man in shirt sleeves held in his hand another of the models—a small wooden panel supporting an arrangement of terminals and wires. He read the label: "Circuits for Automatic Telegraphs. Thos. A. Edison, Aug. 12, 1873."

An original work of our greatest inventor, made, perhaps, with his own hands, by a prank of fate had ended up in Cohen's pushcart, there to rub against other devices long forgotten and to be mauled over by a curious crowd. A grotesque finale to inventive effort. It seemed almost tragic. And yet, one could see that even among the most obscure of the models in that array were ideas which had been important and useful in their day. Now they were old and cast aside.

"Where did these things come from?" I inquired of Cohen, the pushcart man.

"I got 'em at an auction by Isenberg around the corner," said Max. "A lot of us got 'em. Such a business of junk!

"A man named Linn—K. Linn—bought them from the government—thousands of them—from the Patent Office. The auction man sold them around there on Broome street."

I recalled, then, how some months ago the national Patent Office, having abandoned its requirement of models of inventions, had cleaned house of some 200,000 models which had accumulated through many years. The most famous of them were set aside for museums; the remainder were sold at auction to the highest bidders. About 15,000 passed into the hands of a New York dealer, while the rest went to dealers in Baltimore, Md., where they were stored in a warehouse for future disposal. In New York the whole lot went under the hammer in a sale which netted some $3,500.

Each a Factor in Our Progress

Crowd around a peddler's pushcart on the lower East Side, New York City, eager to examine the working models of the once important inventions now being offered to the highest bidder. Here, in endless succession, are spread the dreams and hopes of bygone inventive genius

THE chief purchasers were pushcart merchants. And so thousands of the contrivances which represented ingenuity and countless hours of labor, and for years had held a place of some dignity in government offices, found their way to the curbs of Orchard street.

"Two hundred and fifty dollars I spent for this stuff," Cohen was saying, regretfully, "and for what? People, they come and look; but they don't buy. Why not? Bah! These inventors, they break their heads to make things, and nobody buys!"

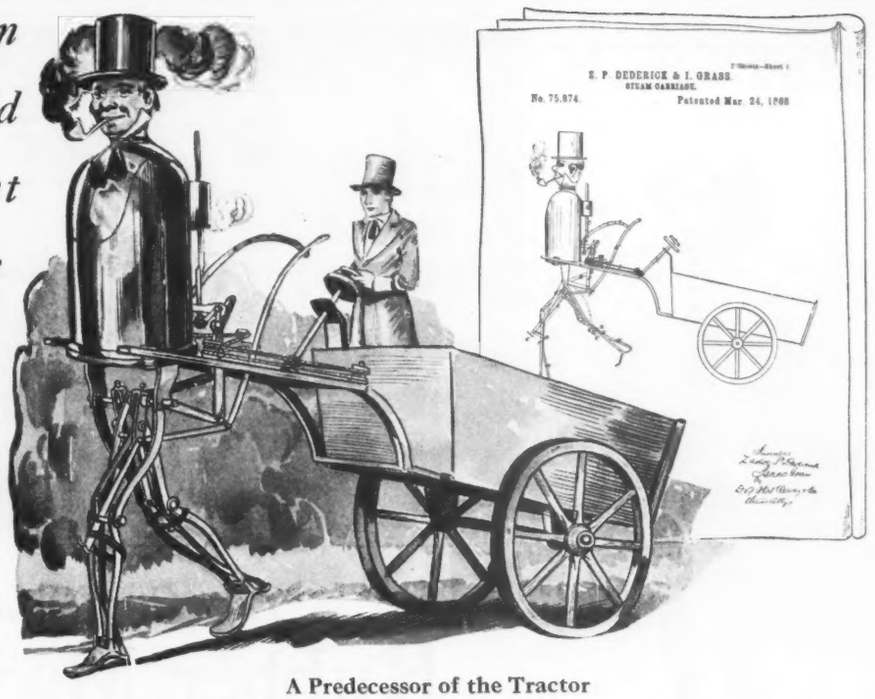
"What do you ask for them?" I ventured.

"Ask? I ask what I think I can get—maybe twenty-five cents, maybe a dollar, maybe five dollars; and if I find a sucker, maybe I ask ten dollars or twenty-five dollars. See? You know how it is. That's business. . . . Hey, Sam!" he called.

A coatless youth of some eighteen years sauntered up to the pushcart. "Sam," directed the elder Cohen, "show him the rest of the stuff."

Sam Cohen led the way down the street to a trapdoor on a level with the sidewalk. He drew a long key from his pocket and opened the door, and together we descended a flight of steps into a black hole jammed with goods of every description; old clothes, picture frames, furniture, books, all jumbled together. He switched on a light.

Inventions of Edison and Westinghouse Sold As Junk When Patent Office Cleans House



A Predecessor of the Tractor

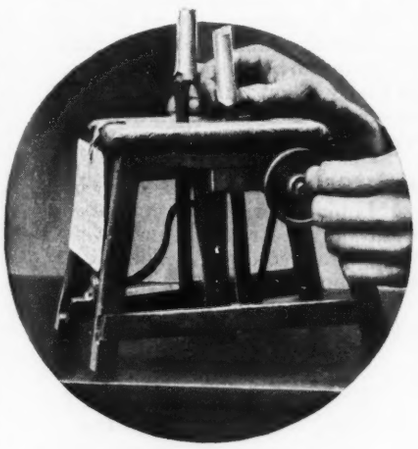
Drawing, from the original patent papers in 1868, unearthed in the model sale, of a cart hauled by a "steam man" controlled by levers, invented by two Newark, N. J., men

"There they are," he said, pointing to a row of shelves at the far end of the cellar. The shelves were crammed to overflowing with inventions, thrown together in wild disorder. Other models were scattered on the floor.

We climbed over piles of junk, and soon Sam was enthusiastically handing down the models, one by one, for my inspection. As he did so it was apparent that he, like many another American youth, was fascinated by inventions. Each of the strange devices, as he held it in his hands, seemed to thrill him with its hidden mysteries and its romance. So, as we examined the models, we began to speculate on their origin, who had made them, how they worked, and what they were for.

"Gee, but some fellows worked awful hard to put these things together," he said, tugging at a printing machine of heavy brass. "Funny, too, how many of the things are like what we have now, only not so good."

I agreed. In more than one of these contrivances, many of them crude and clumsy, one could trace the early history of some common convenience or economy of the present day. Each represented a distinct step, however small, in the development of a useful idea.



The grandfather of the modern vibrator, a mechanical "rubbing apparatus" of 1872

An original work of our greatest inventor, Edison, made perhaps with his own hands, sold at the recent auction for a few cents

Street-car fare boxes, for example. From the dates on the tags, it appeared that about 1870 fare containers were among the most popular subjects for the inventor. The models were of many kinds and descriptions, from a little padlocked metal case which the conductor evidently carried on his belt, to a large wooden case with glass windows, strikingly like the "pay as you enter" boxes on surface cars today. But the choice one of the lot was a little tin car, like a stagecoach, gaudily painted in red and yellow. Along the sides were tiny cushioned seats, with metal funnels at the ends leading down into boxes beneath. Apparently the passengers were supposed to drop their fares into the funnels. From such ideas undoubtedly grew our modern automatic fare registers and the subway turnstiles.

AGAIN, in the pile we found one of the grandfathers of modern bathroom plumbing — a self-draining washstand. Evidently the inventor, N. O. Bond by name, grew weary of the old earthen washbowl and pitcher. So he took a board, cut a round hole in the center, and attached a metal bowl under the opening. In the bottom of the bowl he cut a small outlet for the drain.

Then, too, we found one of the forefathers of the modern electric vibrator. This model was tagged, "Rubbing Apparatus for Medical Purposes. G. H. Taylor, 1872." It consisted of two cloth-covered arms operated through an arrangement of levers from a hand crank at the side.

"See how it works," said young Cohen delightedly. As he turned the little crank, the two arms moved up and down with a rapid rubbing motion.

There were door locks, many of them, representing attempts of inventors to solve the age-old problem of keeping burglars out. Here were predecessors of the present-day tumbler locks. In one model, patented in 1877, the inventor apparently accomplished, by an elaborate combination device, much the same safeguard against lock picking which today is provided by a single key. Under the doorknob he placed two rows of little push buttons, each bearing a number. To unlock the door, it was necessary to push these buttons in a certain combination. Finding the keyhole on a dark night would be an easy job in comparison, but at least it must have added something to the difficulties of the thief.

BURGLAR alarms apparently were another favorite. A typical model consisted of a signal board with rows of knobs resembling the stops of a pipe organ. On these knobs were labeled the various rooms in the house—"dining room," "parlor," "front bedroom," and so on. If a burglar opened a door in one of the rooms, a mechanism which neither Sam nor I could quite figure out would ring a bell, at the same time pushing out the knob indicating the room.

Buried under a "fertilizer distributor," an "improved sewing machine," and a whiffletree, we came upon an early effort to create a noiseless typewriter. One would naturally think such an invention would be somewhat complicated; as a matter of fact, it was the simplest of the lot. The model couldn't have taken the inventor more than an hour to build, for it was simply a cardboard case to cover a typewriter, with only the keys (represented by thumb tacks) protruding. Undoubtedly it deadened some of the noise, even though it must have proved impracticable. At any rate, it embodied an idea which later was made successful.

Among the more curious inventions was an improved tombstone. The model bore no label, but, as Sam observed, it probably was the (*Continued on page 116*)

A rubber plantation on the Malay peninsula, Asia. Right, tapping the trees for the gum; below, a coolie carrying the collected sap to camp

Tire Costs May Be Cut by

Rubber Made from Oil

Other Fascinating Chemical Substitutes

By Edwin Ketchum

BEFORE long, experts say, your car may ride on tires of oil! In place of india-rubber from the East Indies may be substituted synthetic or artificial rubber from the waste of petroleum wells, a new wonder of the chemists' laboratories. Just as chemists have extracted dyes, perfumes, flavors, from coal formerly wasted, so now they are at work to extract value in by-products from petroleum. And chief among these is rubber.

One reason why the chemists are busy in this new field is the fact that today the world, and the United States in particular, is facing a critical shortage of crude rubber. Largely because of the automobile, we are using up rubber faster than it can be produced. In four years more, experts tell us, the world's demand will exceed the supply by some 37,000 tons unless new sources of supply are found. And the United States will suffer most of all; for while we have only about one sixteenth of the world's population, we consume about ninety percent of the world's rubber. To make matters worse, not a ton of what we use is grown in the United States; and Great Britain, the largest producer, recently has curtailed her rubber exports.

To imagine what might happen if our supply of rubber should suddenly give out, just stop a moment and make a list of all the things you see and use every day that are made in whole or in part of rubber. The first thing that occurs to you, no doubt, is the rubber tires on your car. But now go through the list of your personal belongings. Begin with the heels on your shoes, and add the garters around your legs, the buttons on your coat, the fountain pen, eraser-tipped pencil and comb in your pocket, your shaving brush, your raincoat, and so on. Then enumerate the many rubber articles used in your home, in industry, in medicine and surgery, in radio and electricity, and in sport.

The list seems endless. In fact, it has been estimated that at least 30,000 different articles have india-rubber as their basis. In less than a hundred years since Charles Goodyear showed how to vulcanize rubber, this product of the tropics has grown to be one of the vital necessities of life, without which modern industry, commerce and transportation would be virtually paralyzed.

THE increasing shortage has been felt in higher prices. So critical does the situation appear that Congress not long ago appropriated half a million dollars to find a means of relief.

At least four methods have been suggested by Paul L. Palmerton, chief of the rubber division of the Department of Commerce. One is to make our present rubber supply last longer by conservation; a second is to attempt to grow our own rubber in the Southern states; a third is to find a substitute in common shrubs and weeds, such as milkweed, that produce latex, the white, sticky fluid which is the basis of rubber, or to reclaim old and worn rubber, such as old tires, and mix it with new rubber. And finally, to make synthetic rubber.

Some of the fascinating possibilities of this last named source of supply were described the other day by two well-known research chemists, Professor James F. Norris, director of research in organic chemistry at the Massachusetts Institute (*Continued on page 123*)

Old tires on a Pacific coast dock waiting to be shipped to a factory where the rubber is reclaimed. Tests have shown that tires made of 25 percent reclaimed rubber average about 7,000 miles' service

How *to* Keep Cool *on* Hot Days

A score of unusual ways our readers have found to keep comfortable in summer—An announcement of the winners in our "Hot Weather Hints Contest"

WHAT is the best way to keep cool in hot weather?

We asked this question in our April number, and offered prizes for useful and ingenious answers, believing that out of the thousands who swelter in the summer time there must be some who had found a way to beat the thermometer.

From deserts and baking prairies and ordinary towns, have come hundreds of letters offering breezes of comfort. Most contributors had a hard time keeping themselves down to one hint. Although in awarding the prizes only a single suggestion from each letter could be considered, we are passing on a score to you with the additional hint that, when the temperature mounts, you select the one that seems to give you the most hot weather comfort.

John L. Ginster, of Whitesboro, N. Y., wins the first prize of ten dollars for the best practical hint with the following suggestion: "A hot shower bath followed by a hot drink, taken during the hottest part of the day." This, he says, he has learned from experience gives immediate relief.

In his surprising method of obtaining coolness through heat, he is backed by science. The hot bath cleanses and opens the pores of the skin; the warm drink induces perspiration, which also cools off the body. The chief business of the skin, physiologists tell us, is not to throw off poison but to regulate the temperature of the body. The pores, opening and closing, are the doors through which the body heat must escape. Heat opens them; cold closes them. Plunge into a tub of very cold water and the pores close tight, shutting in the heat, with the result that after your bath you feel hotter than ever. Warm water has the opposite effect, opening the pores wide and letting the heat escape.

The hot drink helps in causing perspiration, which cools you through evaporation. Much depends on the humidity of the air about you. If you are suffering from *dry* heat, the more you perspire the better, for the dry air will take up the moisture from your skin. If the air is moist, already saturated with water, perspiration drops will remain on the skin surface and feel uncomfortable. Most regions in the United States, however, have low humidity in the summer time so that the drink, Mr. Ginster explains, is a good addition.

A second suggestion offered by many has close connection to this idea of letting the body heat escape. This is to reduce the amount of heat in the body that has to be let out. You can do this by avoiding heat-producing foods.

Mrs. L. S. Oliver, of Maywood, Ill., makes her suggestions concrete. "Eat oranges, grapefruit and the seasonable fruits," she urges, "nonstarchy vegetables and raw vegetable salads. Eat lightly of meats, breads and potatoes, and very lightly of cakes, pies and candies. Our household has tried this method of keeping cool for several years and found it good. My husband, who is eighty-two years old, stands hot weather far better than those around us."

In hot weather, vegetables and fruits should march at the head of the procession, for of all the kinds of fuel with which we stoke our bodies these produce least heat. Meats keep our body stoves roaring. Sugar, giving us heat in winter, is no friend in summer.

Sweet drinks are one of the foods to be avoided. A single icecream soda, dietitians point out, often contains as many calories as a whole meal of meat, vegetables and bread.

"Wear cool clothing," is the next suggestion, meaning clothes that are light in color, loose in weave and worn loosely to permit free circulation of air.

Ken Prince, of Gooding, Idaho, says, "It is a well-known fact that light-colored goods reflect the sun's rays while the dark colors absorb them. Wear white, or light colors, to keep cool. Woolen goods form an air space which holds the heat in and cold out. Vegetable fibers such as linen and cotton let the air in and out more freely."

THE weave of cloth makes even more difference than the color, for loosely woven cloths permit better circulation of air, which is the chief secret of coolness. To carry off body heat and perspiration, air must move between the clothing and the skin. As soon as the layer of air next the skin has taken up all the heat and moisture that it can hold, it should be pushed on and replaced by another layer of fresh air. Enough clothing to protect the skin from the heat rays of the sun, touching the skin as little as possible, is the ideal formula. Arabs who live on the desert keep comfortable by wearing a single garment of smooth white cotton so that air circulates constantly over the surface of their skin. A suit of short cotton

THE PRIZE WINNERS in Our Hot Weather Hints Contest

First Prize—$10

John L. Ginster, Whitesboro, N. Y.

One Dollar Prizes

Mrs. L. S. Oliver, Maywood, Ill.
Ken Prince, Gooding, Idaho.
Dr. H. E. Ingrisch, Milwaukee, Wis.
Mrs. Sarah Ross, Urbana, Ill.
Samuel Oliva, Danbury, Conn.
Mrs. Clarence Berkheimer, West Milton, Pa.
Mrs. C. M. Smith, Perry, N. Y.
Mrs. E. F. Fitch, Jacksonville, Fla.
Major Carruthers Ford, Calgary, Alta., Canada.
R. J. Hubbard, Grady, Ark.
Robert Davies, Jr., Denver, Colo.
Charles S. Tuller, New Orleans, La.
J. G. Van Hook, Burnside, Ky.
J. E. Campen, Norfolk, Va.
Edward H. Flaharty, Parco, Wyo.

An Idea from the Tropics

A damp screen of cloth placed on rollers and hung over the windows lowers the temperature of a room considerably by means of evaporation

Cool Thoughts Help, Too

A few suggestions for keeping cool. Think of cold subjects. Let cold water run on your wrists for a few minutes. Put a fan outside window to cool the air coming into the house

Wear Suitable Clothes

For comfort on hot days wear light colors in clothes. They throw off the heat. Dark colors absorb heat and hold it to the body

underclothing, covered by a loose white cotton shirt and trousers, is probably the coolest European costume.

One suggestion is to cool the blood by holding the wrists under the cold water faucet and letting water run over them for three or four minutes. This is the favorite practice of Dr. H. E. Ingrisch, of Milwaukee, Wis.; Mrs. Sarah Ross, of Urbana, Ill.; Samuel Oliva, of Danbury, Conn.; Mrs. Clarence Berkheimer, of West Milton, Pa., and Mrs. C. M. Smith, of Perry, N. Y.

If you want to take a comfortable nap in hot weather, Mrs. E. F. Fitch of Jacksonville, Fla., advises: "Use a water bag filled with cold faucet water for a pillow. Ice water is too cold."

Another group of hints tells how to cool off your body by cooling off your surroundings. Since heat will leave your body only if the temperature of your surroundings is lower than your own temperature, this is extremely important.

THE well-known plan of hanging wet sheets or towels in a room to reduce its temperature through evaporation has been modified in an ingenious way by Major Carruthers Ford, of Calgary, Alberta, Canada, who fixed up a roller towel arrangement over the windows of his house on the inside. Any curtain material can be used, he says, but muslin is as good as any. The lower roller is in a shallow pan of water on the window ledge. "Give the curtain a spin through the water," Major Ford directs, "and leave it alone until it is quite dry." This damp screen, he claims, proved so effective in British Guinea, where he tried it first, that a native servant fond of sleeping back of it took pneumonia from the unaccustomed coolness.

R. J. Hubbard, of Grady, Ark., suggests that you add a "cooling canvas" to your sleeping porch. A gutter trough runs around the heads of the windows in his own sleeping porch, in which water is pumped on hot, dry days. "From this gutter," Mr. Hubbard explains, "is suspended thick, loosely woven canvas. Water trickles down through this canvas all day long, and air passing through the water-soaked canvas cools my porch and sleeping room."

Late discoveries in ventilation show that comfort comes not so much from lowering the temperature in a house as in keeping the air moving. Many told of unusual ways in which they put their electric fans to work.

"Instead of churning up the warm air inside with an electric fan," Charles Shepard Tuller, of New Orleans, says, "I put a shelf outside my bedroom window and put my sixteen-inch electric fan on it. This starts a cool typhoon blowing in through the screen. I have reduced the temperature of a room six degrees in one hour, and this cooling continues the longer the fan runs."

Robert Davies, Jr., of Denver, Colo., puts his fan in the cellar. "Our house is heated with warm air," he explains, "and of course there are several cold air pipes coming from the cellar. I cut a small door in the main pipe, placed a small pan with ice in the bottom of it, and a small electric fan before the pan. By leaving the fireplace open, a most agreeable breeze circulated through the whole house."

H. C. Dickinson of the U. S. Bureau of Standards, an authority on ventilation, suggests that the most effective way to keep your house cool in hot weather is to apply some kind of insulation to the rafters of the roof and then keep the attic well ventilated. "In any case," he says, "ventilate your attic well."

"The general practice of opening up everything as wide as possible in the daytime," he continues, "is usually a poor method of keeping cool. The house should, of course, be well ventilated at night, but in many cases it is desirable to close up fairly well in the daytime in order to preserve as far as possible the coolness of the night before. Certain portions of the house, such as the kitchen, must necessarily be well ventilated in the daytime, but such portions can be closed off from the rest of the house most of the time."

In getting rid of the heat in the body, the mind should not be forgotten. In fact, many put that first. "Keep calm," they advise. "Take it easy. If you're going to quarrel, do it in the winter."

"Never allow yourself to become excited, worried, angered or heated in an argument," says J. G. Van Hook, of Burnside, Ky., "or in the daily routine of your work. The condition of the mind is a great factor in keeping cool. We often hear such expressions as: 'He felt his blood run cold.' If persons become impatient and nervous, we speak of them as being 'hot-headed.' Both of these are merely conditions of the mind."

HE ADDS this idea, which psychologists call the "power of suggestion": "If we are made to think of cold objects, we become somewhat chilled. I have in mind a writer who, while describing a snowstorm in Alaska, became so cold that he was obliged to build a fire to warm himself although it was in midsummer. This was brought about by a condition of the mind. Decorate the walls of your home and office with pictures of sleighing parties, snow scenes, huge icicles and frozen streams. They will help greatly."

"After a desert experience of eight years in Needles, Calif., in the heart of the Mojave Desert," contributes J. E. Campen, now of Norfolk, Va., "where the thermometer registered constantly at least one hundred and fifteen degrees in the shade, the best heat forgetter is to keep working. Don't try to force forgetfulness of the heat, but just become too interested in your work even to think of the heat. Above all things, shun 'heat conversations.' "

Eat Nonheating Foods

Do not overeat in hot weather. Eat green vegetables and raw fruits which produce less heat, and sparingly of meat and sweets which contain a high percentage of calories

"After all," writes Edward H. Flaharty, of Parco, Wyo., "we are not forced to live in Death Valley in summer where the temperature goes to a hundred and thirty degrees, or the top of Pike's Peak in winter, when the cold sends the mercury in our thermometers out of sight. In the sections of our country where the masses live, extremes are not beyond human existence or the masses would not be there."

Statistics compiled by insurance companies show that, in fact, the summer months in most regions of the United States are the most healthful in the year. The death rate is much lower; there is far less disease. Summer is the time for sport and enjoyment. Try this year to get your full share.

Ten Ways to Keep Cool

1. **Keep skin pores active.**
2. **Eat cooling food.**
3. **Avoid sweet drinks.**
4. **Wear light, loose clothing.**
5. **Put wrists in cold water.**
6. **Sleep on water bottle filled with cold water.**
7. **Cool off surroundings by evaporation (wet sheets, towels, windowscreens, etc.)**
8. **Keep the air about you moving.**
9. **Keep your mind cool, by being calm and unhurried and thinking of cool objects.**
10. **Keep busy, and you'll forget the heat.**

Do You See *All You* Look At?

Study this picture very carefully for a minute and a half; then turn to page 120 and answer the questions about it

A New Quiz to Help Measure Your Powers of Observation—Other Fascinating Tests

Do You Think Clearly?

WRITE "false" after each of the following statements which cannot possibly be true. Allow yourself two minutes, then turn to page 120 for your rating.

1. He missed his car, but saved time by walking ahead until the next car came along._____

2. The boy walking alone in the woods stopped suddenly, very much frightened at the approach of a tramp._____

3. Standing in the shade of the tree, the people were sheltered from the hot sun and managed to keep out of the rain._____

4. After going beyond the repair shop at high speed, his engine suddenly stopped, but he coasted back again to get it repaired._____

5. Standing in the deep shadows of the garden, he saw the officer's shield flash as he paced up and down on the sidewalk._____

6. They used the beams of the old house to build a new one, and left the old house as it was._____

7. Blinded by the explosion, he rushed out for help, guided by the light from the fire._____

THE drawing on this page, reproduced by courtesy of the Bureau of Public Personnel Administration, offers a test of your powers of observation. When you look at a scene, how much of it do you really see?

Study the picture for a minute and a half. Then turn to page 120 and answer as many as possible of the fifteen questions about the accident which you will find there, without referring again to the picture. These questions have to do with such things as the time and place of the accident, how it happened, and other pertinent facts that a policeman, newspaper reporter or other trained observer would be expected to see and remember. Spend seven minutes on the answers.

As you study the picture you may, if you wish, make written notes of the things you see, referring to your notes in answering the questions. Then try the other two tests on this page, prepared by Dr. A. M. Johanson of the department of psychology, Columbia University.

Here are fascinating tests that anyone can enjoy. In addition, you will find they will help you to get a line on yourself by measuring your mental equipment. They form one of a series of tests appearing from month to month in POPULAR SCIENCE MONTHLY.

Can You Connect Ideas?

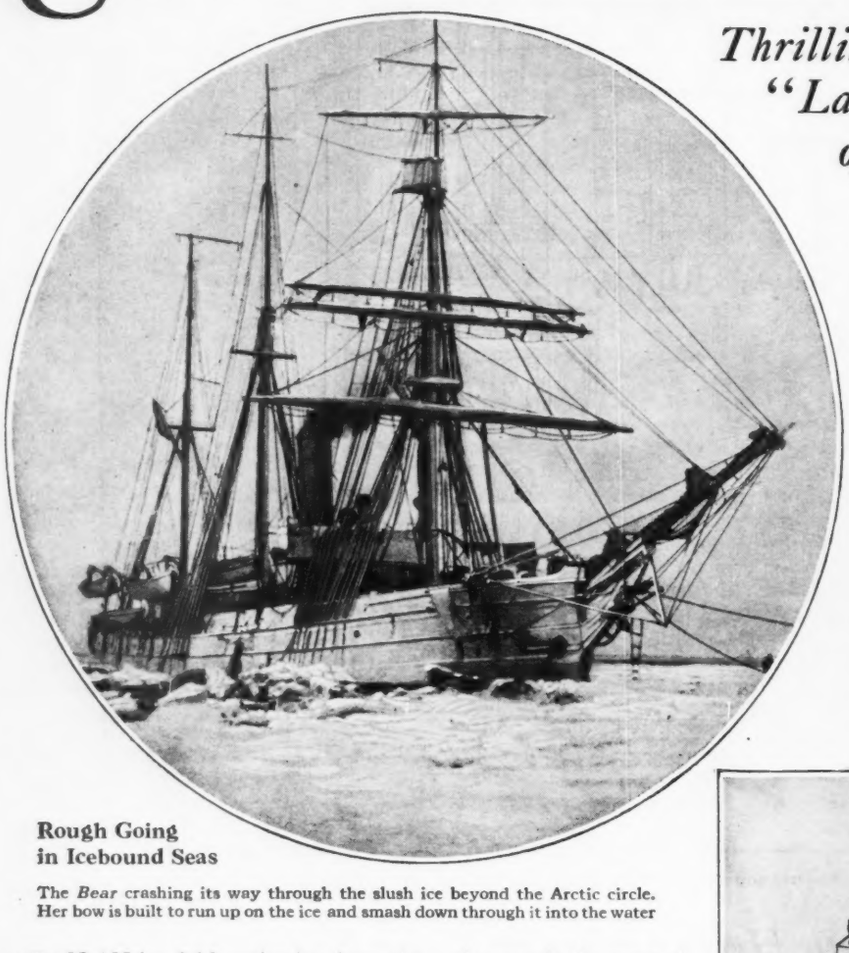
NAME a class to which each of the following belongs; for example, "oak—tree." Count the time it takes (in seconds) to complete the list, then divide the time by 20 to get your average time per word. See page 120 for your rating.

oak	penny
measles	dictionary
July	cabbage
shark	Rhine
quinine	murder
beef	dog
canoe	sparrow
banana	London
Atlantic	football
Alps	rose

Uncle Sam's Arctic Policeman

Thrilling Stories of a Famous "Law and Order" Ship of the Far North

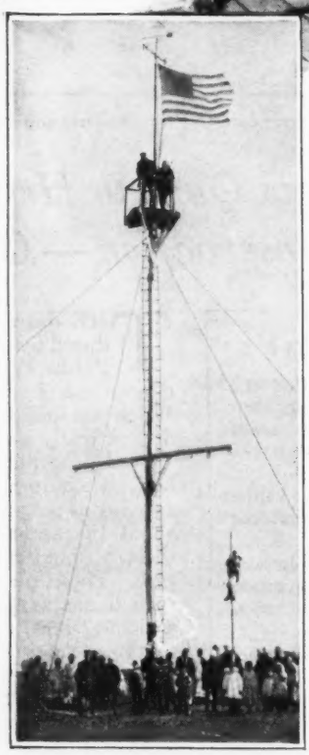
By H. H. Dunn



Rough Going in Icebound Seas

The *Bear* crashing its way through the slush ice beyond the Arctic circle. Her bow is built to run up on the ice and smash down through it into the water

Captain C. S. Cochran, who commands U. S. cutter, the *Bear*, and his pet collie, Laddie



On this lookout at Point Barrow, Alaska, men watch day and night for the arrival of the *Bear*, with mail, medicine and supplies

ON AN ice field projecting from the shores of Kotzebue Sound, six men and three women are seal hunting. Without a sound the great ice pan slips away from the shore and out into the current that rushes through Bering Strait and on to the Pole. Their hunting finished, the men and women—nine black dots on fifty square miles of ice—pack their seals and start for home. They reach the edge. There is no village, no land, no friendly igloos—nothing but water. No one on the land has missed them; no kayaks have put out to rescue them. There is nothing ahead, apparently, but death in the icy Arctic currents. Frantically they start to build a snow house for protection against the oncoming night.

Down below the horizon a gray-white ship is cruising leisurely along the coast. The lookout spies the black dots on the ice field and shouts down to the deck, "Men adrift on ice." The ship leaps ahead at full speed, and soon overhauls the floating ice. The nine castaways are rescued and brought back to their village on Kotzebue Sound.

The ship is the old wooden United States Coast Guard cutter, the *Bear*, which for thirty-nine years has been the only law, the only policeman, the only physician, the only hospital, the only food supply, the only representative of Uncle Sam north of Nome, Alaska.

Her home port is San Francisco, but from the beginning of July until October she patrols the coast of Alaska and the lower Arctic ocean, covering in her yearly cruise more than 10,000 miles. In the last thirty-nine years she has covered at least 400,000 miles or nearly sixteen times the distance around the world. In that long period she has saved thousands of persons from death by starvation, freezing, disease and intertribal war.

Unaided, the *Bear* has made vain the boast of the freebooters that "there is no law north of fifty-four." The channels and the open sea from Sitka on the south to Demarcation Point on the north she has made as safe as the best policed city in the world. To the Eskimo she has insured freedom such as prevails in the United States, and has made his property safe both from dishonest whites and from native raiders from near-by points on the Siberian coast.

And now, after thirty-nine years of uninterrupted duty, the *Bear* is sailing the northern seas for the last time. When she returns at the end of her fortieth cruise this fall, she is to be retired from active service and her place taken by an all-steel ship of much the same type.

While she was making preparations for her last voyage, I visited her in her berth in the Oakland estuary on San Francisco Bay. After having been shown over the old ship and learning something of her work, I asked her commander, Captain C. S. Cochran, if he did not find the long trip through the dismal northern seas dull and tiresome.

"No," he replied, seemingly amazed that I should consider such a thing possible. "Why, we live four or five months packed with adventures every year. From the time we leave the Commissioner's court at Nome early in June until we stop there again on our way home in October, every day is filled with thrills. We guard the natives and the whites who live along the coasts of northern Alaska, and look after the interests of the United States. We protect the seal herds of the islands and the reindeer herds of the land. We feed the hungry, heal the sick, bury the dead, marry the

living, and divorce them too. And we punish the criminal when we catch him. Always there is something new, something out of the ordinary, something exciting."

Captain Cochran then went on to tell me of some incidents that constantly are recurring and that make the day's work an absorbing task.

"Some years ago we were near the mouth of the Colville river, east of Point Barrow, northernmost tip of American domain in the Arctic, when a skin kayak came bobbing over the rolling sea. In the jargon of the coasts north of sixty, the boatman told of a spirit that stalked through his tribe, killing ceaselessly. The *Bear* anchored, and the ship's physician with his assistants went ashore. When they returned, an epidemic of smallpox had been halted and the Eskimo given a new lease on life.

"CRUISING slowly along the shores of more southern islands, below the Circle, the man in the crow's nest not infrequently reports a motor schooner, all sails down, half hidden behind some islet. The wrappings are taken off the rapid-firer up in the bow, and we round the island just as the schooner starts out. A shot across her bow brings her to, and boat and crew of seal poachers are taken to Nome for trial.

"From the top of an ice mound near an Eskimo village, a queer signal is often flown. It consists of a pair of fur trousers and a woman's calico skirt. The lookout on the *Bear* sees it. The steamer comes to a stop, blows her whistle, and from six to fifty kayaks put off from shore. A man and woman wish to be married, possibly several couples. All come aboard, and, on the main deck, the ceremony is performed, and much entertainment follows. When two signals are raised, one a pair of pants and the other a skirt, a divorce is sought, and, if there are legal grounds for it, it is granted, signed, sealed and delivered, right here on board.

"Sometimes it is a polar bear which has gone bad and needs killing. Then there is a hunting party on shore, and the skin of the bear goes back on board.

"Men and women with broken limbs are brought to the ship by their relatives and then, repairs made in the floating hospital of the *Bear*, taken back home. Like the Chinese, the Eskimo never forgets a kindness, and myself and the other officers are overloaded each year with gifts from those we have helped the year before.

"The only mails go north and come south each year on the solid decks of this sturdy old ship.

"At Point Barrow, the northernmost tip of Alaska, there is a lookout station, kept by the service for the benefit of traders and natives. As the time for the arrival of the *Bear* approaches, men are chosen to remain day and night in this lookout, so that, when the patrol ship comes in, the village may send out a fleet of boats to meet her and escort her to her anchorage.

"Late in September, some years ago, the *Bear*, on her way home, was near Point Barrow when a kayak approached from the shore. 'Smoke,' cried the boatman, pointing toward the Pole. The lookout in the crow's nest found a wavering column of shadow about twenty-five miles north. The bow of the steamer was swung around, and back we went, smashing through slush ice, until at length the outlines of two ships appeared beneath the smoke. A dog team was sent out, and before morning reached the hulls of two whaling ships, frozen in solid, short of food, prisoned by their own daring in remaining too long beyond the Circle.

"The dog team traveled back and forth until food enough to last through the winter had been transferred to the whalers' decks. Then once more the *Bear* resumed her course to the warmer waters of the Pacific. So you see we have seldom many dull, uninteresting stretches," he concluded.

The *Bear's* crew numbers about fifty, and among them they carry a dozen pets and mascots, ranging from Laddie, Captain Cochran's snow-white collie, to a large and husky alley cat, which adopted the ship one evening four years ago, as she lay at her berth in the Oakland estuary. Besides these, there are other dogs and cats, a goat, a small black bear, an occasional polar bear cub, numerous seals and walruses (while they are small), and now and then some of the larger sea birds, which land disabled on the steamer, where the good doctor fixes them up and keeps them until they are able to take wing again.

Though the *Bear* is built entirely of wood, she has survived storms and ice jams from which she has had to rescue iron vessels. She is so built forward that she can be driven up on the ice, where her weight smashes through to the water beneath, instead of having to cut straight ahead into the ice, as the steel-prowed iron vessels do. Triple sheathed with six-inch planks of oak, the *Bear* is one of the few remaining examples of a type of ship construction which has passed away.

AFTER she is retired, her work will be carried on by an all-steel, Diesel-driven schooner, of approximately the same size, which is to be ready by the spring of 1927. The same captain and the same crew which have been taking the old wooden patrol steamer north every year since 1914 will be in charge of the new ship, which will have the same name as the retiring veteran. So, although the beloved old boat no longer patrols the icy seas, her name will still live, and her beneficent work will go on uninterrupted.

To the new *Bear*, too, will go the carved wooden figurehead—a polar bear—which now looks out from beneath the bowsprit of the present ship. When the old *Bear* comes back from her ten thousand mile patrol this fall, she probably will be converted into a museum of relics of the Far North for some one of the coast cities of California, if she can be obtained from the national government.

The *Bear's* Beat

The route taken by the *Bear* in her yearly patrol of Uncle Sam's northern possessions. She has covered at least 10,000 miles each summer for the last thirty-nine years

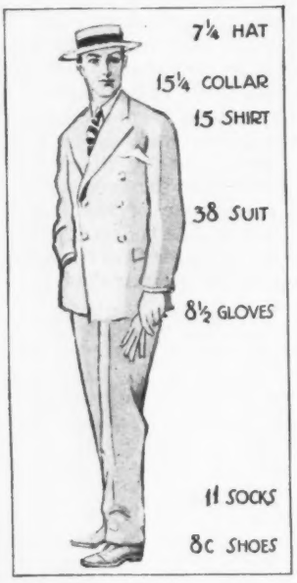
Some of the crew of the *Bear*, with five of the dozen or more pets of many different species that are always carried on board the cutter

A summer home, or "skin house," of the natives of St. Lawrence Bay, Siberia, visited by the *Bear*

Next Time You Buy Clothes—

Remember That a "Regular 38" Suit May Not Always Fit a Man with a 38-Inch Chest—How to Order Haberdashery

By Lidda Kay



Mr. Average American

COULD you determine your own clothing sizes?

If you didn't know the size of your shoes, could you buy the right pair of socks for yourself simply by measuring the length of your foot?

If your wife should go shopping tomorrow and volunteer to buy the gloves you've been needing, could you give her the correct size? Ten to one you'd squint at your outspread hand, pump your memory-crank to recall your usual size, and finally give it up with, "Oh, about 7½, I guess!"

Now, clothing design, when it comes to sizing and measuring to meet the varying proportions of the human figure, is an exact science. The proportioning of men's suits to varying heights and girths, for example, is about as scientific an operation as anything that has to do with the making of your clothing.

A man recently sent an order by mail to a New York clothier. He was going on a business trip, wanted a size 38 suit, said he measured 38 inches around the chest, and added that he was of normal build. The clothier had his doubts, but rushed out a regular 38.

Eventually the suit came back, with an indignant letter. It seemed that though the chest fit was perfect, the waist length was too short, the sleeves hung a little below his elbows, the trousers exposed more of his violet socks than even his best girl liked to see, and the pockets were so high that he had to crook his arm to get his fingers in them!

THE fellow was taller than the average, a circumstance he neglected to state. He was of normal build, yet he was far from being the "regular 38" on which the clothiers base their measurements.

What makes a man a "regular 38"?

I put the question to Harry Simons, editor, teacher and clothing designer, who knows perhaps as much about the scientific measuring of men's suits as anyone in the country.

"If a man is 5 feet 8 inches high," he said, "and measures 38 inches over the vest around the chest, and 34 inches around the waist, he can consider himself an average, normal figure and a 'regular 38.'

"Then, if he is absolutely regularly proportioned, he will also measure 15½ inches around the neck, and have a waist length of 17½ inches. These figures are not guesswork. They are based on a study of the science of human proportions and on actual measurements of thousands of men.

"The average American we consider, for purposes of clothing design, to be 5 feet 8 inches tall. This tallies almost exactly with fact, for the American soldiers in the World War averaged 5 feet 7½ inches in height.

"IF A man is 5 feet 8 inches, or a little more or a little less, he is a 'regular,' and we have our regular set of measurements for him. But if he is 6 feet or over, he is a 'long,' and if he is 5 feet 4 or under he is either a 'short' or a 'stub.' All three need three different sets of measurements.

"Our scale for different heights is based on certain proved facts. For every inch a man grows over 5 feet 8 inches, his waist length increases ¼ inch, his sleeve length ¼ inch, and his leg length ½ inch. Remember, I am speaking of averages and of regularly proportioned figures. In ninety cases out of a hundred, the seat measure is 2 inches more than the chest measure. A regularly proportioned man with a 38-inch chest, however, will usually take a 15¼-inch collar. For every inch increase in the chest, the neck usually increases ¼ inch, irrespective of the height.

"As soon as a man's waist measure equals his chest measure, he goes into the 'stout' class, even if his waist is only 36. And 'stouts' require still another set of measurements.

"People ask me if men are getting taller, thinner, stouter, or shorter—judging from the scales of measurements.

"Well, men are getting smaller waisted. Height and chest measurements today are about as they were sixty years ago, as the Civil War and World War records show. But twenty years ago a regular 38 called for a 35 waist, whereas now it is down to 34 and is even approaching 33.

"Where you live seems to decide your waist line, too. The middle westerner has one inch more at the waist on an average than the easterner, particularly the New Yorker. It isn't that the middle westerner spreads, but the poor easterner is 'congesting'!"

An Automatic Shoe Fitter

This ingenious machine, recently devised for use in shoe stores, not only measures the foot automatically but stamps a number on a card, enabling the salesman to pick the correct size. Here the card is being inserted

Miss Average American

As for women's dress sizes—

Theoretically, the woman who is classed as the "perfect 36" measures 36 inches around the bust. Actually, the "perfect 36" dress is made for a 38 or 38½ bust. A man measures thus and thus, and that's that. A woman changes her figure, by different methods of corseting, to conform to the lines in vogue at the moment.

GERTRUDE EDERLE, swimming champion, is at least one woman who finds difficulty in conforming to the lines in vogue at the moment. Miss Ederle wears a 36 swimming suit, but if she wants a dress or blouse that will span her shoulders and approach within speaking distance to her wrists, she must buy a 40. Her powerfully developed shoulders are plainly not those of the "perfect 36."

"No, the reducing wave isn't changing the average woman's dress measurements at all," declared one pessimistic manufacturer. "Women are getting fatter, if anything. They are riding around in automobiles too much. They have entirely too little to do!"

As proof whereof, one dress manufacturer recently added 2 inches to the hips of his 1926

(*Continued on page 124*)

What All Modern Industry Owes To ELI WHITNEY

How America's Pioneer Inventor, Robbed of His Cotton Gin, Made the World Rich

By ROBERT E. MARTIN

NO MAN fought a braver fight against disheartening odds than Eli Whitney, pioneer American inventor. Though his cotton gin ushered in a new epoch in industrial history, to him it brought only poverty, scorn and bitter disappointment

The Machine That Made Cotton King

"See!" cried Whitney. "It is finished. It does the work!" And Mrs. Nathanael Greene, widow of the Revolutionary hero, and her plantation superintendent stood spellbound, watching the raw cotton cleaned by machine

IN THE year 1792, at Mulberry Grove, a broad plantation near Savannah, Ga., there lived a woman of motherly hospitality—the widow of General Nathanael Greene of Revolutionary fame. Into her home she had welcomed a tall young man of 27 years who, having just graduated from Yale College, found himself stranded in a strange city, penniless and without friends.

The young man's ambition was to study law, but he was also a mechanic of uncommon skill. While he accepted the widow's kindnesses, and while he continued his studies, he busied himself at odd jobs about the plantation, repairing farm implements and furniture, and devising ingenious playthings to delight the children of the house.

To Mulberry Grove one day came three distinguished visitors, officers who had served under General Greene in the Revolution and who owned plantations in another part of the state. As they sat in the great parlor chatting with Mrs. Greene, the conversation turned to the sorry plight of southern farmers and the dearth of profitable crops.

"'Tis a shame," remarked one of the officers, a Major Pendleton, "that we cannot make cotton growing pay. Everywhere the short staple cotton thrives, yet the labor of separating it from the seeds takes away all chance of profit."

"TRUE," rejoined Major Forsyth. "For one man to clean a single pound of cotton is a good day's work. A pity there is no mechanical device to do the task."

Mrs. Greene interrupted.

"Gentlemen," she said, with sudden inspiration, "why not tell your needs to my young friend, Mr. Eli Whitney? He can make anything!"

She led her guests to a small workshop in the basement, where they found the student-mechanic at his bench.

"Mr. Whitney," said the widow, introducing the officers, "these gentlemen want you to make them a machine that will separate the seeds from cotton, and I have told them I believe that you can do it for them."

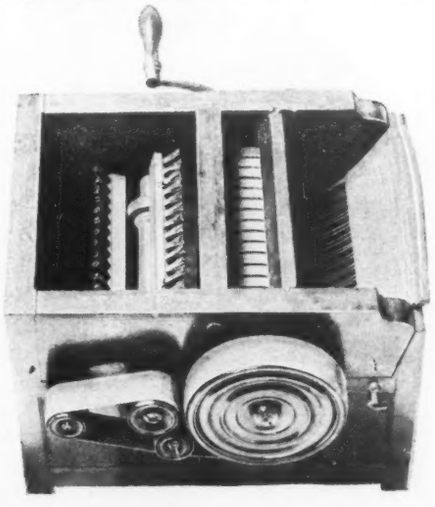
Whitney stared in amazement.

"Why," he exclaimed, "never have I seen cotton nor cotton seed in my life!"

But far into the night, after the guests had departed, he pondered over the unusual request. From boyhood his delight had been to contrive and fashion new things with his hands. Now, his very ignorance of cotton lured him to match his skill against the problem it presented. Perhaps, too, here was his chance to finance his study of law. A machine to pull the seeds from cotton. It seemed not impossible. At least, he could try. But first it was necessary to see some cotton.

Early next morning he rode into Savannah, fourteen miles away. In vain he searched the warehouses for a sample of cotton, for it was out of season. At last, on a river boat tied to the wharf, he found a handful of the stuff, and with this hurried back to his workshop. In dim lantern light he set to work, examining the fibers and pulling them away from the seeds with his fingers. As he did so, the idea of the machine grew in his mind. He would make mechanical fingers perform the work of human hands.

The fingers, he decided, should be of wire. They should be made to catch the white fibers and draw them through a slit too narrow for the seeds to pass. The idea seemed simple enough. But would it work?



Whitney's original model of his cotton gin, now on exhibition at the National Museum, Smithsonian Institution, Washington, D.C.

FIRST of all, he needed wire. Another search of Savannah proved that not a scrap of it could be bought. Whitney, however, was resourceful. On the plantation he found a package of wire that had been intended for a bird cage. This he drew to the right thickness for his purpose. Next, he needed tools. Those in his workshop were inadequate for his needs, so he fashioned new ones with his own hands.

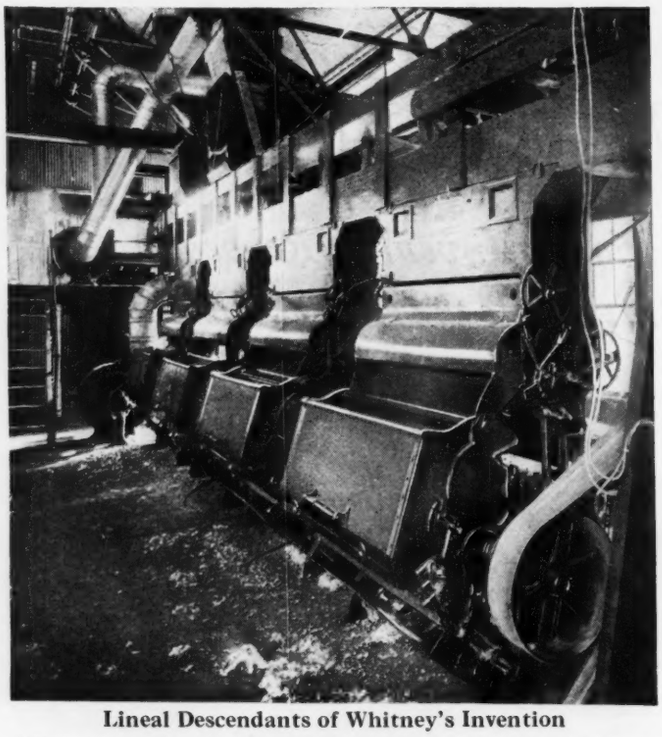
For eight months he labored, day after day, sharing his secret only with the woman who had befriended him and with Phineas Miller, the plantation superintendent. Then, one afternoon in the spring of 1793, he called excitedly for them to come into his shop.

"See!" he cried. "It is finished. It does the work!"

On the bench before them they saw a small wooden box, about two feet high, fitted with a hand crank. Into an opening at the front of the box Whitney began feeding a quantity of raw cotton, at the same time turning the crank. They saw the cotton pass between two parallel cylinders, one fitted with rows of sharp hooked teeth made of wire, the other with a series of brushes. As the cylinders revolved, the teeth caught the cotton fibers and dragged them through a narrow

grating, or grid, which excluded the seeds. While the seeds dropped to one side, the brushes carried the cleaned cotton to the other.

Such was the world's first cotton gin—a machine destined to do the work of a thousand men, to open millions of acres of land to profitable cultivation, to revolutionize the dress of men and women everywhere, and to add millions of dollars in wealth to American industry and commerce. Such was the invention which made it possible for us today to have cotton in a thousand forms and fabrics in the vast quantities we require and at prices we can afford to pay.



Lineal Descendants of Whitney's Invention

They are power driven, and various refinements have added to their efficiency; yet these modern cotton gins in principle are the same as the first little machine fashioned by Eli Whitney in his basement workshop in 1793—an invention which made it possible for us today to have cotton in a thousand varied forms and fabrics, and in the vast quantities we need each day

MRS. GREENE was jubilant over the success of her young friend. Phineas Miller saw visions of speedy riches. Immediately he offered to Eli financial backing, and proposed a partnership. But little did either of them know that the invention they saw before them, while it would lift thousands from poverty to prosperity, would bring to the genius who created it only the dregs of want, scorn and bitter disappointment; that he would live to see the entire fruits of his labors stolen from his hands, and himself reviled by the public which he enriched.

Nor did they dream, on the other hand, that out of his tragic struggles would eventually come another and even greater contribution to the world. They could not foresee that Eli Whitney would go down in history not only as the pioneer American inventor, but as the father of all modern industry. For it was Whitney who later conceived and applied for the first time the idea of standardized interchangeable parts in manufacture, thereby revolutionizing the whole course of commercial enterprise.

ALL this was to come, but not until the courage and persistence of the young mechanic had been tried to the limit through a dozen evil years.

At the moment of that first demonstration, however, the cotton gin seemed to offer nothing but promise.

"Wonderful!" exclaimed Mrs. Greene, as she watched the seeds drop beside the little box. "My friends must see it work. Mr. Whitney, you will be famous!"

Quickly she ordered the erection of a small building in which the new wonder might be displayed. Then she invited influential friends to Mulberry Grove to inspect the machine.

They came—politicians, statesmen, country gentlemen and planters—and they marveled. What they saw was that a little mechanical box smaller than a trunk could clean more cotton in one day than a slave could clean by hand in many months. They saw, too, that this magic box would treble the value of their lands overnight.

The news spread like wildfire. Everywhere it aroused a desire to possess the secret of the strange machine hidden behind locked doors at Mulberry Grove. Men began to whisper, and to scheme.

One midnight in June a band of black figures crept stealthily upon the plantation. The great house was in darkness. While Eli Whitney slept, perhaps dreaming of fortunes to come, the figures moved swiftly to the little outbuilding. A sudden grinding and wrenching of splintered boards broke the night stillness. A dog barked. The shadowy forms slunk away. Then all was silent once more.

When Eli awoke the next morning, his first thought was of his model. That day he was to add the finishing touches, and then he would apply for his patent. In high spirits he hurried out to his work. What he saw made his heart stand still. A splintered door of the little building sagged open on its hinges, and, within, the room was empty. The cotton gin was gone!

At that moment, in an old barn a few miles away, half a dozen men were gathered excitedly about the mysterious little box, examining its parts and studying its operation.

THE secret was out. As Eli stood gazing into the empty room which a few hours before had held the invention on which he had labored so long, he could scarcely believe his own eyes. Gradually there came upon him the full realization of the odds that were set against him. He must begin again. This time he must battle with thieves. Not only must he face the problem of manufacturing and marketing his machine, but in doing so he must compete with his own product! The task seemed all but hopeless.

Should he attempt to go on, or should he surrender his invention without a struggle and continue his studies toward his chosen profession?

In the end, the audacious theft served as a challenge to Whitney's fighting spirit. He determined to take the gamble. With funds advanced by Phineas Miller, he hurried to New Haven, Conn., to get his patent and begin the manufacture of cotton gins, while Miller remained in Georgia to distribute them.

From the outset the battle turned against him. Even before he could complete a new model and apply for a patent, a number of cotton gins, copied from his invention, were in profitable operation.

"The people here are running mad for cotton gins, and they care not who supplies them," wrote Miller from the South.

"My workmen have fallen victims to an epidemic of scarlet fever which is raging here," replied Whitney from the North. "I can do nothing."

BUT he kept on. A year passed, and then, with the first machines from the shop he had established in New Haven, Whitney journeyed the road back to Georgia. To his utter amazement, he found that those who had robbed him were being accepted by a money-mad public as the legitimate operators of cotton gins, while he, the rightful inventor and owner, was regarded as an intruder and usurper.

Everywhere juries turned against him. Intimidated witnesses refused to testify in his behalf. The public laughed in his face. Weary, discouraged, but still unbeaten, he returned to the North, this time by packet. On the way he was shaken by fever. And when the ship reached New (*Continued on page 125*)

She's a Real Water Sprite!

FOR eighteen months Miss Maxie Meitzner, seventeen years old, of Riverton, N. J., a licensed diver, has been doing diving work on the Delaware river. It is believed that she is the youngest woman engaged in this unusual business.

Steel Highways under Hudson

Giant Twin Tubes Will Accommodate 46,000 Automobiles Daily

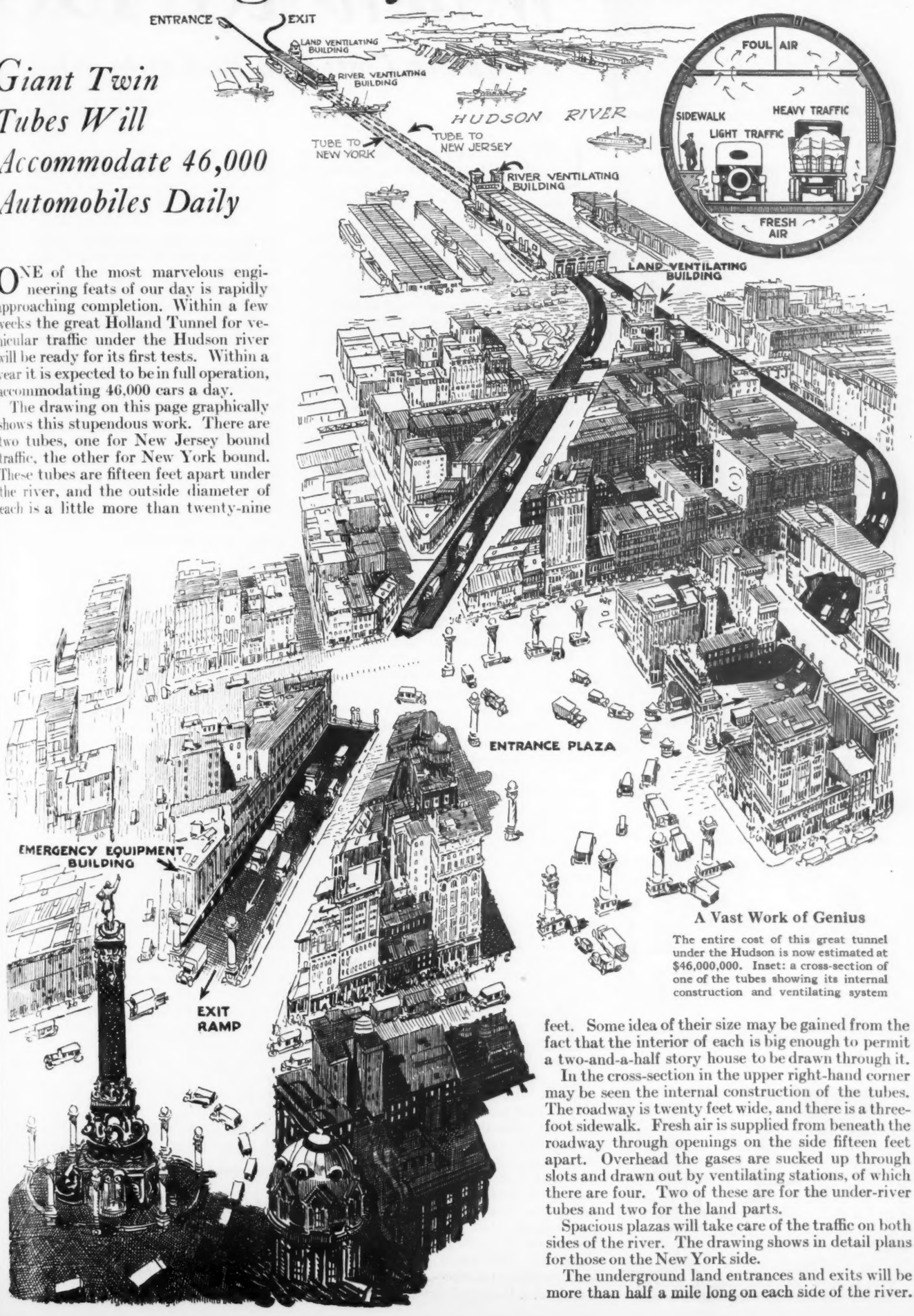
ONE of the most marvelous engineering feats of our day is rapidly approaching completion. Within a few weeks the great Holland Tunnel for vehicular traffic under the Hudson river will be ready for its first tests. Within a year it is expected to be in full operation, accommodating 46,000 cars a day.

The drawing on this page graphically shows this stupendous work. There are two tubes, one for New Jersey bound traffic, the other for New York bound. These tubes are fifteen feet apart under the river, and the outside diameter of each is a little more than twenty-nine feet. Some idea of their size may be gained from the fact that the interior of each is big enough to permit a two-and-a-half story house to be drawn through it.

In the cross-section in the upper right-hand corner may be seen the internal construction of the tubes. The roadway is twenty feet wide, and there is a three-foot sidewalk. Fresh air is supplied from beneath the roadway through openings on the side fifteen feet apart. Overhead the gases are sucked up through slots and drawn out by ventilating stations, of which there are four. Two of these are for the under-river tubes and two for the land parts.

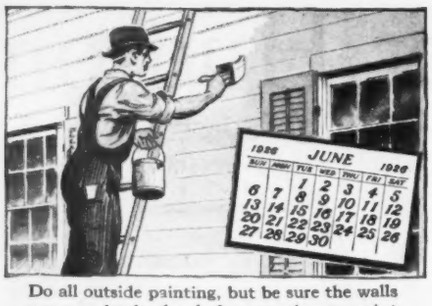
Spacious plazas will take care of the traffic on both sides of the river. The drawing shows in detail plans for those on the New York side.

The underground land entrances and exits will be more than half a mile long on each side of the river.

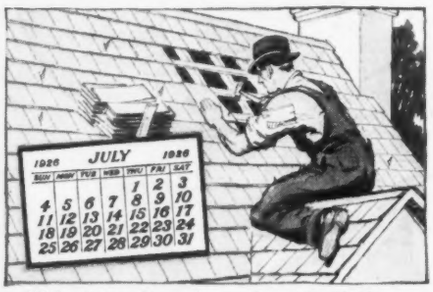


A Vast Work of Genius

The entire cost of this great tunnel under the Hudson is now estimated at $46,000,000. Inset: a cross-section of one of the tubes showing its internal construction and ventilating system

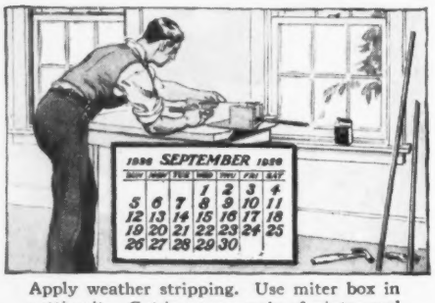


Do all outside painting, but be sure the walls are completely dry before starting to paint



Make thorough repairs on the roof. Replace all missing or rotted shingles, and stop leaks

Waterproof with tar the outside cellar walls, and cover with dirt so sun will not melt it



Apply weather stripping. Use miter box in cutting it. Get in your supply of winter coal

Get the heating plant ready. Put up smoke pipe. Clean the chimney from the roof down

Take down screens and screen doors. Rake up the leaves around the house. Start furnace

When to Do

Upkeep Costs Can Be Cut by Making

By JOHN R.

UPKEEP is a little brother to Overhead. They're a devious pair whom most people prefer to ignore. Yet in various guises they intrude themselves upon us all the time and help to keep our pocketbooks lean. Not content with their legitimate prey, they porch-climb, as it were, the simplest home. Something ought to be done about it, but what? The trouble is, it takes a professor to differentiate between these clever crooks, and Sherlock Holmes himself would be put to it to detect them in the act.

It is possible, fortunately, for us to size up the more barefaced activities of Brother Upkeep and to checkmate him to a large extent. We can anticipate his raids and see that he doesn't get away with the house and lot, too. Doubtless Overhead is responsible for interest, taxes, insurance. We can't help those items, usually. But it is certain we can minimize the leaks and losses that Upkeep inflicts from season to season through deterioration and depreciation.

The advantage of home owning over renting is variously estimated as equal to four to six months' rent saved. This includes every factor. Depreciation proper, or the cost of physical upkeep, is often estimated at one percent yearly of the house value. That is, on an $8,000 house, $80 worth of repairs are needed each year. Such an estimate is a rough guess, for much depends on the grade of dwelling and also the section of country. Upkeep is less on a good house than on a poor one. Then there is the element of timely care. Furthermore, the cash outlay may be reduced by half or more if the owner does his own work.

It is a good thing to have a month by month schedule of repairs, so that the various jobs can be anticipated and done in the proper season. A midwinter blizzard is no time to patch a leaking roof, nor is the fly period suitable for repairing screens. There is also the point of service and economy in buying equipment, as a heating plant, in the off-season, and likewise in hiring certain work to be done.

The following is my idea of a repair schedule, which may be modified by the reader to suit his own local conditions. We start with the current season:

JUNE. Prepare for general outside painting in dry weather. After rain, give the walls two or three days to dry out. A little dampness is permissible only on shingles when you want to save stain. The most enduring stains for shingles are red, green, and gray. To burn off old paint from woodwork is the practice of professionals, but it is slow and fire-hazardous for the amateur. Use a putty knife and wire brush to remove any scaly or flaking surfaces.

Put on a thin coat first, follow with a heavier second after drying, and add a third for extra fine work. Just one medium coat may serve. Take the raw linseed, mix with white lead, a little turpentine, and a mite of dryer. Lampblack added makes any gray shade desired, and a trifle of it makes white lead whiter. The enduring colors for outside work are white, gray, yellow. For inside, almost any color will hold.

The professional house painter likes to mix his own because it goes farther, but even he admits that some brands of ready-mixed paint are first class. Buy a couple of good brushes, and between jobs keep the bristles immersed in water, hanging the brushes by a wire through holes in handles.

Clean out the cistern, if any. Unlimber the lawn mower. Do any cement work—rain is good for it—patching or renewing walks. Give mosquitoes no breeding place in tin cans, etc., outdoors; oil surface of water in pond or ditch.

JULY. Make thorough roof repair in place of earlier makeshifts. Apply liquid roofing to leaks or entire surface; use plenty around chimneys and vent pipes. A six-foot hickory pole securely fitted to a wide roofing brush saves the back and speeds the job, enabling one to use both hands on the handle—where a low-pitched roof permits standing. Black is the most enduring and cheapest of the asphalt materials, but red and green may be had.

On tin roofs, holes should be soldered; but if the tin is so far gone that solder won't adhere, we must apply roof cement, which is a thick mixture of asphalt and asbestos. Where expansion has split the tin seams, insert strips underneath, then nail and solder. Patch, paint or replace flashing. Put in new shingles as needed, and apply roof stain if desired.

Inspect gutters and leaders for patching, painting or replacement. Extra gutter spikes may be needed on ice-forming north side. This is also the time for any carpenter work on pillars, steps, and porch, above or below. Where there are stains of dampness, the wood may be decayed: poke it with a screw driver or something and find out. Interior decay soon travels to the surface. It may be checked with liquid asphalt, creosote, or paint.

An old shingle roof that is tight the rest of the year may leak in a sudden

IN THIS article, one of a notable series on house building and home ownership, Mr. McMahon tells you how to keep your house in first-class condition. Next month he will discuss house exteriors.

ODD JOBS

Your Repairs on a Monthly Schedule

MC MAHON

July shower, because the dried-out shingles crack and separate. While not serious, the midsummer leak gives us a hint of the need for future renovation.

AUGUST. This climax of the dry season is best for excavation, whether of well, septic tank, cesspool, drain or water lines. Not only is digging easier, but you can tell now whether a well is dependable or merely holds surface drainage. Also, earth walls do not now cave in, and may be used for one side of concrete forms. Again, it is easier to detect a leak in a drain or water line.

We may likewise do all kinds of general building without much need for weather protection, thereby saving material and avoiding damage. If foundations or cellar walls need tarring or cement plaster outside, do it now. Clean up last month's jobs of outside painting and roof repair.

The kind of tar suitable for waterproofing the outside of cellar walls is a hard substance that must be heated over a fire. Yet a hot sun will cause it to run after it is applied, therefore fill in with earth against the wall as completed. The same material is a good decay-preventive for wooden posts in the ground. A brush once used in the heated tar is about done for. On the other hand, liquid asphalt may be readily washed out of a brush with gasoline.

SEPTEMBER. If a new heating plant is required for the coming winter, install it now before the rush. When everybody is clamoring for furnaces and service, you may not be able to get either or you may have to accept a substitute along with hasty, inferior installation. Look into all the latest systems and devices, including the oil burners. Besides the large improvements in the heating art, there are small features of value, like water heaters, that may be added to almost any furnace. Fix up the coal bin and don't delay putting in the winter supply of fuel.

Unless done in the spring, renew floors, whether with new material, linoleum, paint, varnish or wax. To prepare an old floor for painting or varnishing is quite a job, but it pays to spend time on the preliminaries. Use a plane, or an electric machine, to level and smooth the surface. Bad spots may be sandpapered. Fill large cracks with putty or special compound. Apply a filler coat, then follow with the final surface, allowing plenty of time for drying out. If the woodwork of a room is to be stained, painted or enameled, it should be done before the floor. Fancy work on trim means four or five coats with sandpapering between. Most people find enough labor in two or three coats.

Apply weather stripping to windows and doors while it is still comfortable to have them open. This job, besides saving a couple of tons of coal each year, stops the annoyance of window rattling in wintry breezes. Use a miter box to saw stripping, have materials handy at each window, and it is not a hard chore. Metal stripping is best, but wood with rubber insert lasts very well. Felt stripping wedged into cracks with a putty knife will do for shed windows.

Now is a good time to fix up that attic room or extension workshop with fiber board, plaster board or something else that will make it snug and usable. Do you need a cold compartment in your cellar for fruit and vegetables? Make a little room with concrete blocks or double thickness boards with air space, building paper and a layer of tar roofing on the cold, damp side. Insulate the door on the cold side. The ceiling should be insulated, too, and there should be at least one window for light and ventilation.

OCTOBER. Get the heating plant ready to fire up, first cleaning the chimney from the roof down. With an inflammable roof, and soft coal or wood fuel, it is perilous to neglect the chimney. Use a wire brush on a pole or rope, and after cleaning see whether flues or brickwork need repairs. By pointing up loose bricks with cement and perhaps replacing chimney cap of concrete, we may avert danger and postpone complete rebuilding. For this job, dampen old brickwork thoroughly, use a good mix of cement, protect from frost and dry out for a week. Reinforce chimney cap with heavy wire mesh.

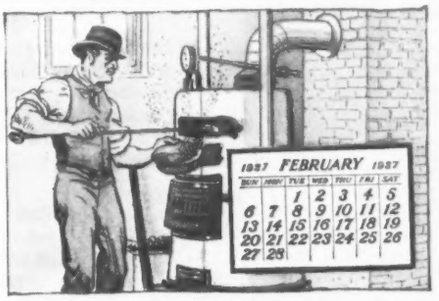
Connect furnace smoke pipe—new if required. Cement smoke pipe into flue with a weak mixture cement, molded asbestos or half and half. This is a gas-tight safety measure I've used for years. And it is well to have asbestos board or other fireproofing on beams directly above the furnace.

Flush out steam boiler and refill with water to proper level. If the outlet faucet is rust-choked so the water won't flow, take it out with a wrench and clean. Cover all steam pipes with asbestos jackets and the elbows with asbestos powder moistened to a putty. For the latter application, it is best to have heat in the pipes. If you have difficulty in getting steam pipe jackets, do not wrap on asbestos paper and wire (*Continued on page 118*)

Mr. McMahon is at your service to help you solve your building problems, and will be glad to answer letters addressed to him in care of POPULAR SCIENCE MONTHLY, 250 Fourth avenue, New York City.

Fix doors of garage or outbuildings so they will open easily when ground is frost-swollen

Shovel off snow settling on low-pitched or flat roof. Keep ice from clogging the roof gutters



Give heating plant thorough once-over, especially getting after soot. Add water to boiler

Look over screens and screen doors, mend holes, paint frames and mesh, if not copper

Dig out the leaves from under the hedges, and carefully clean up all rubbish on the grounds

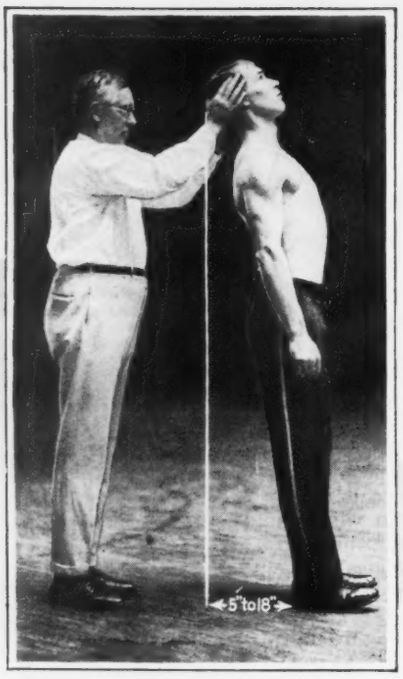
Whitewash the cellar. Put on screens and screen doors. Drain and clean heating plant

Stand RIGHT

These Ten-Minute Exercises Will

A HEALTHY, efficient body is the first need of every young man who intends to make a success of his life. He needs it to enable him to do his work well, and also to enjoy the rewards won by his work. The young man who has a naturally good body should start *now* to keep it good; the young man to whom nature has been less kind should begin *now* to educate his muscles to be the useful servants of his mind. This series of easily learned ten-minute exercises, originated by Dr. J. H. McCurdy, will make it possible for you to keep what you have and gain what you lack, even if you have little time to devote to exercise.

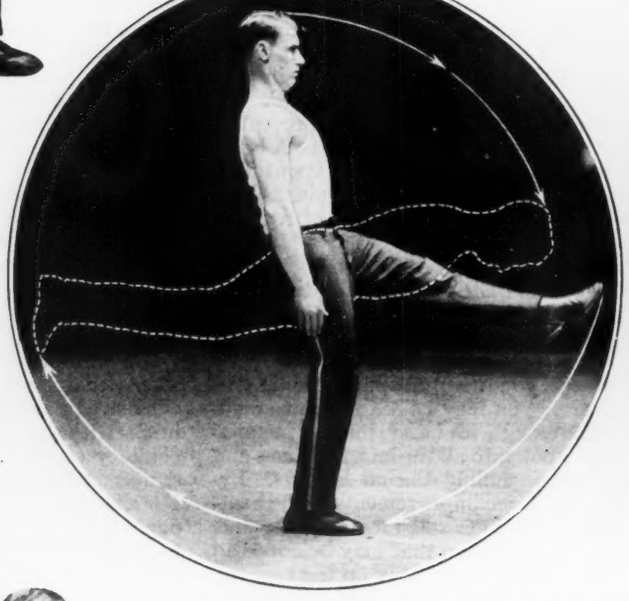
Dr. McCurdy, a leader in his profession, is an authority on physical education. As a physician, he has specialized in the study of the relation of exercise to health. Part of his work is done in a study the tall shelves of which are lined with medical and scientific books; as important a part is done in the gymnasium of the International Y. M. C. A. College in Springfield, Mass., where, as director of the physical education normal course for the



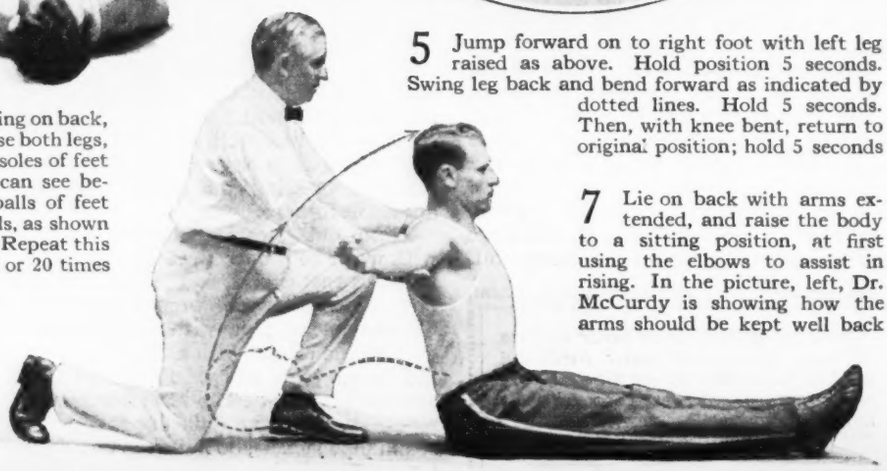
2 Stand 5 to 18 inches from wall. Lean back on heels, without bending the back, until head touches wall. Repeat 10 to 20 times. In the picture Dr. McCurdy's hands represent wall

1 Stand as tall as possible, in position shown above, elbows well back and the abdomen drawn in. Press head against the resistance of hands. Repeat 10 to 20 times

3 Standing on one spot, use running stride, with weight on balls of feet. Raise the knees as at right alternately 60 times, keeping body erect. This is "running in place"



6 Lying on back, raise both legs, turn in soles of feet so you can see between balls of feet and heels, as shown above. Repeat this some 15 or 20 times



5 Jump forward on to right foot with left leg raised as above. Hold position 5 seconds. Swing leg back and bend forward as indicated by dotted lines. Hold 5 seconds. Then, with knee bent, return to original position; hold 5 seconds

7 Lie on back with arms extended, and raise the body to a sitting position, at first using the elbows to assist in rising. In the picture, left, Dr. McCurdy is showing how the arms should be kept well back

4 Stand erect. Then bend to position above, palms turned to the rear, backs of the fingers touching the heels, and the arms pressed against the hips. Repeat 15 or 20 times

and Be Healthy!

Make a New Man of You

preparation of teachers, he has for thirty years directed the training of young men who were studying to become "Y" physical directors. As Y. M. C. A. athletic director for the A. E. F., he did valuable work in conditioning American soldiers for the game of war. Today his methods are being used in physical education work in all parts of the world.

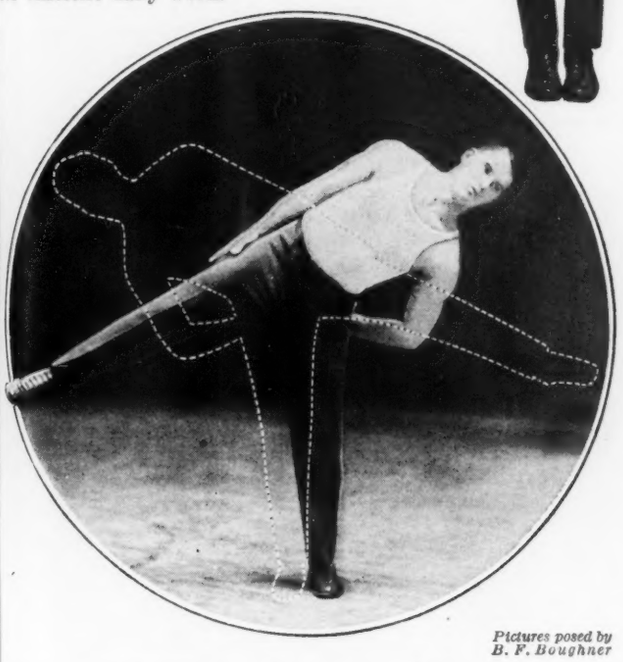
AT THE age of 59, Dr. McCurdy plays a fast game of tennis and is quite able to hold his own with his pupils—all trained athletes—in strenuous handball contests. He practices what he preaches, and attributes his excellent health and unusual physical ability to the fact that he has made a practice of *enjoying* every morning a series of exercises similar to these that he now so generously makes available to readers of POPULAR SCIENCE MONTHLY.

"A good bodily posture is more valuable than big muscles," says Dr. McCurdy. "Start your mornings by going through this series of simple postural exercises. They will tune up your body for efficient daily work."

9 Stand 12 to 18 inches from doorway, with arms extended. Lean back on heels until arms rest against door frame as above, 5 to 15 times. Dr. McCurdy's hands represent door

10 Stand erect, and raise arms first to shoulders, then over head as shown above, keeping arms well back. Repeat 15 to 20 times

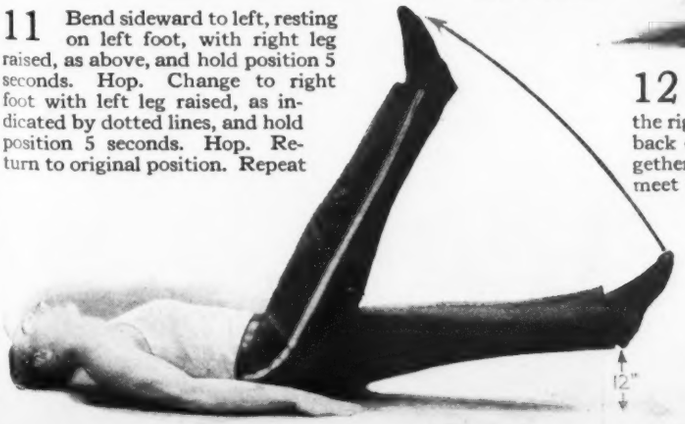
8 This exercise will help you to avoid accidents by developing a sense of balance and conscious control of your body. Stand as at left, heels raised, eyes closed, and hold position, feet close together



Pictures posed by B. F. Boughner

12 Stand erect. Hop to left on left foot, raising right leg to the right. Hold 5 seconds. Hop back on left foot, clicking heels together by swinging left leg to meet the right, as above. Repeat

11 Bend sideward to left, resting on left foot, with right leg raised, as above, and hold position 5 seconds. Hop. Change to right foot with left leg raised, as indicated by dotted lines, and hold position 5 seconds. Hop. Return to original position. Repeat



13 Stand erect with eyes closed. Hop forward on right foot, grasping the left ankle with right hand behind the right knee, as above, and hold position 15 seconds. Repeat, changing from left to right at will

14 Lie on your back. Then raise the legs alternately, keeping the knees straight, as at left, and always keeping the lower leg at least a foot from the floor. Repeat this from 15 to 20 times

March *of* Progress *in* Science

Success Factors, New Serums, Clothes

Knife Cauterizes As It Cuts

For delicate operations, a new instrument, called popularly a "radio knife," has been perfected recently. Its cutting edge resembles a needle through which high frequency electric currents are sent. These currents produce cold sparks that cauterize the wound as the knife cuts without injuring the tissues. In the above photograph are shown the "radio knife" as well as the electric control board

On these pages are presented each month brief stories of scientific discovery and research having practical bearing on our every-day problems.

Old Ideas of Success Wrong

WHAT are the factors that make a man a success or a failure? On this question, which perhaps interests us all more than any other, science of late has been altering our opinions radically.

A long-prevalent idea has been that the only child in a family suffers a decided handicap as far as success is concerned. And so we have been accustomed to pity the pampered youngster who grows up without the companionship of brothers and sisters. Now, however, comes John C. Stuart, psychologist at Colgate University, to upset this notion. From laboratory tests he concludes that the only child goes out into the world with as good a chance of success as a child with many brothers and sisters. This investigator, in his tests, examined 465 students representing families of different sizes. Eighty-one of them were "only children," 124 were from families with two children, and five had nine brothers and sisters each.

Another popular belief which seems now to be contradicted by psychological test is that a person who may be painfully slow in one line of endeavor may be unusually quick in another. Recent intelligence tests conducted at Harvard University indicate that the speed at which you think or act is as much a part of your personality as your disposition.

Students were asked to solve puzzles, complete sentences, and do a wide variety of mental tasks as quickly as possible. The results revealed that the students who showed the greatest speed on one test also excelled in most of the others, and that the rating of each student was practically uniform throughout all the tests. Thus, the experiments seemed to demonstrate that a person who is slow at one thing is also slow at everything, and vice versa.

Don't Blame the Baker

IF YOU are tempted to complain of the bread and biscuits your wife makes, go slow. The trouble may be not in the baking, but in the flour.

For one thing, the flour may be ground too fine. Two chemists of the Food Research Institute at Stanford University, Drs. C. L. Alsberg and E. P. Griffing, have just discovered that too much grinding injures the starch in the grain. As a result, bread rises too fast at first, and then falls.

Excessive grinding also injures the gluten, which makes bread dough elastic, and then the dough is difficult to knead.

Noisiest Place in the World

THERE is at least one place in the world that is even noisier than New York City's busiest street intersection, and that place is Niagara Falls.

Recent tests made with an audiometer, a new noise-measuring instrument perfected by the Bell Telephone Laboratories, showed that the tumult of the cataract at the mouth of the Cave of the Winds would smother the roar and clatter of trains and cars at the intersection of Sixth avenue, Broadway, and Thirty-fourth street.

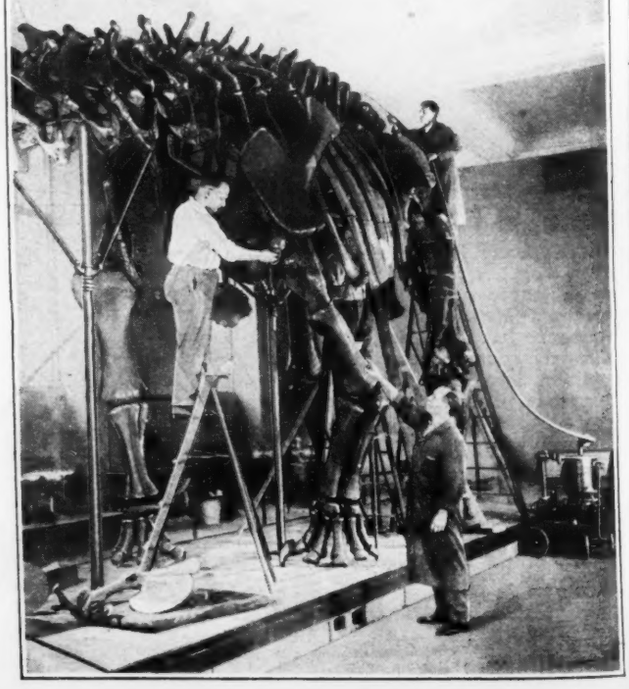
Niagara's noise measured seventy units, while the best that busiest spot in the metropolis could do was fifty-five.

New Victories over Disease

AGAIN the microscope and the test tube have rendered valiant service in the war against man's great enemy, disease. As this is written there comes the announcement from Detroit that Dr. N. S. Ferry, bacteriologist, and L. W. Fisher, chemist, have discovered the tiny organism which causes measles, and with it have succeeded in producing an effective measles antitoxin. Thus another contagious and often serious ailment, which has been regarded as almost inevitable in every household where there are children, soon will take its place with diphtheria and scarlet fever on the list of preventable diseases.

To this list, also, even dreaded tuberculosis may be added before long. For from Paris are reported remarkable successes by Professor Albert Calmette with his recently perfected tuberculosis vaccine. More than 8,000 babies born in tuberculosis infected households have been given this preventive treatment, the vaccine being administered either through the mouth or by inoculation. Of these, less than two percent have died of the disease—a striking reduction from the average mortality of twenty-five percent for European children in tuberculosis homes.

Epilepsy, another disease long held virtually incurable, likewise seems doomed to surrender. Dr. L. W. Childs, direc-



Dusting Off a Dinosaur

Preparatory to being removed to a newly built wing, the great collection of ancient fossils of the American Museum of Natural History, New York City, recently was given a thorough cleaning. The vacuum cleaner was found to be the greatest aid in this work. It took the dust off without scattering it on other exhibits. The picture at the right shows the skeleton of a huge dinosaur being cleaned

Ancient "Lost City" Found

Left: E. J. Bush, of the Museum of the American Indian, reconstructing ancient pottery from the site of America's oldest city (above), found beneath the sands of the Mohave desert, Nevada

tor of the medical department of the Cleveland public schools, is experimenting with a vaccine.

Finally, two scientists of the University of Wisconsin, Dr. Paul F. Clark and Alice Shiedt Clark, working with Dr. L. O. Dutton of the Methodist Hospital, Memphis, Tenn., have announced the discovery of an invisible enemy which devours the deadly bacteria responsible for one of the worst types of blood poisoning and of one of the most severe types of pneumonia.

Bad Roads and Your Tires

HOW much do poor roads add to the cost of auto tires?

An answer has just been given by Professor S. S. Steinberg of the National Research Council's highway research board, through a series of tests in which an automobile was driven over different types of roads.

It was found that concrete or brick roads caused the least tire wear, the loss in weight of each tire being about one ounce for a 500-mile run. The wear caused by gravel roads was from two to seven times as great, while that on macadam was from ten to fifty times.

The results of the tests also proved that the wear on front tires is from fifty to seventy-five percent less than on rear.

Monuments to Our Genius

IF YOU have watched the construction of a modern steel skyscraper rising thirty or forty stories, no doubt you have wondered how long such a mammoth structure will last. Will it, like famous cathedrals and towers of the Old World, withstand the buffeting of centuries?

To these fascinating speculations, a partial answer recently was given by engineers who had charge of tearing down the world-famous Madison Square Garden in New York City. A careful survey of the condition of its iron and steel framework after some thirty-five years of service showed that virtually all of it was in as perfect condition as on the day it was erected, in spite of the fact that few precautions ever had been taken to protect and preserve it.

In its passing, the old Garden, scene of many notable events, at least has demonstrated that the great steel structures of the twentieth century are capable of more than temporary fame, and that centuries from now our tallest skyscrapers may still be preserved as imposing monuments to the mechanical and engineering genius of our age.

The Choice of Summer Clothes

"WHAT shall I wear?" Most of us have been accustomed to answer this question according to individual whims and tastes or commonly accepted notions of what is cool in summer and warm in winter. Now, however, exact knowledge to guide us in the choice of attire is forthcoming from the scientist's laboratory.

In the clothing and textiles department of the Kansas State Agricultural College, tests to determine which clothing fabrics shield the skin best from the rays of the sun, have shown that sunlight penetrates cotton and linen faster than either silk or wool; in other words, that animal fibers absorb more of the sun's rays than do vegetable fibers. The tests proved that through linen a good sunburn was produced by summer sun in one and one half hours; through cotton in two hours; through wool in seven hours; and through silk in ten hours.

Just how much ultra-violet sunlight is beneficial or harmful to our bodies, still is an open question. But, meanwhile, those of us who are susceptible to sunburn now can know what to wear when we sit out on the beach this summer.

A New Serum for Tetanus

The only known tetanus anatoxin has been produced recently by two Paris scientists, Dr. Charles Ramon of the Pasteur Institute, left, and Dr. Christian Zoeller of the Val-de-Grace military hospital, right. They are also given credit for the discovery of a diphtheria anatoxin

To Study Sun's Radiation

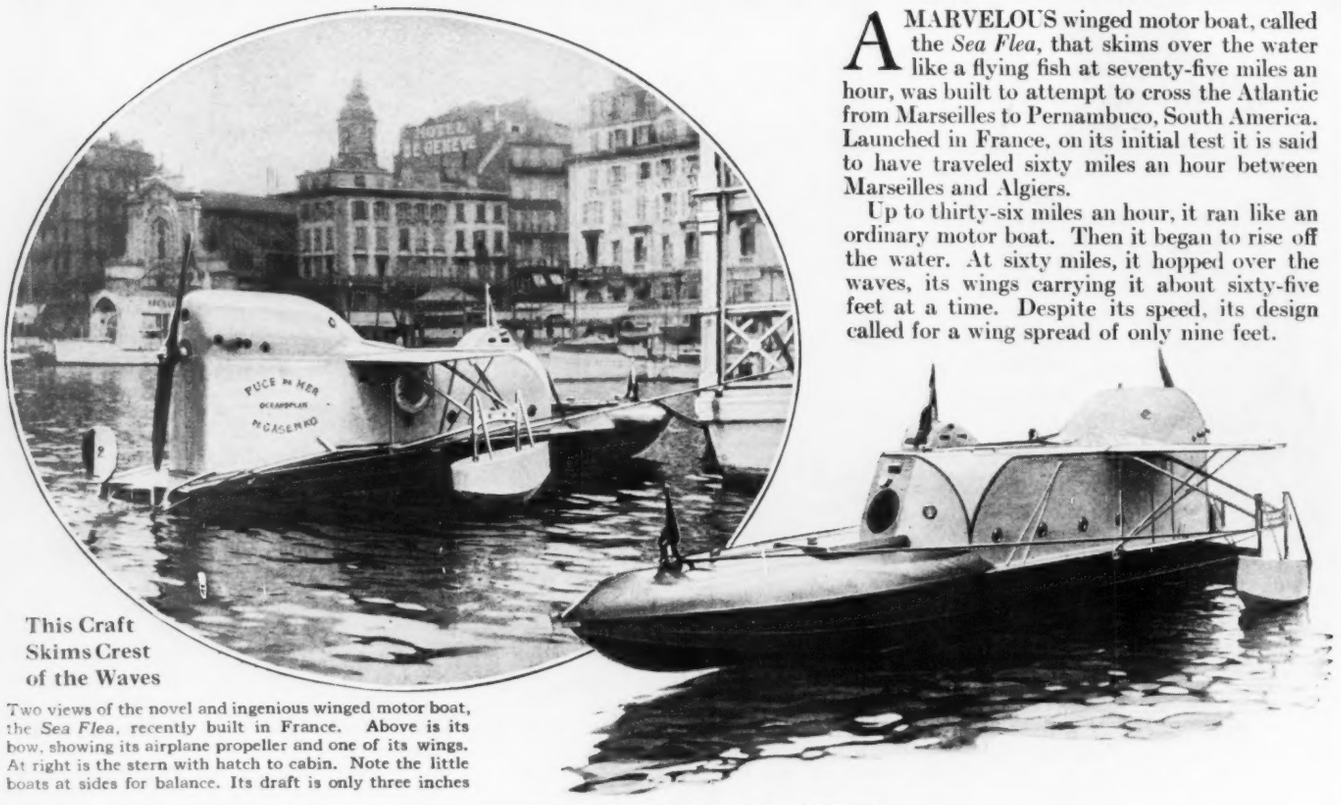
ODDLY enough, one of the most primitive regions in the world soon will be the scene of one of the most exacting and far-reaching undertakings of modern science. In the wild plateau land of the Hottentots and the Bushmen are to be set up the most delicate instruments of astronomy in a remarkable attempt to establish a means of making accurate long-distance weather forecasts.

Dr. Charles G. Abbott, head of the solar radiation expedition of the National Geographic Society, recently announced that Brukkaros, in Southwest Africa, had been chosen as the site for an observatory where the sun's rays will be measured every day for a period of four years. These measurements are expected to determine whether variations in the sun's radiation can be gaged accurately enough to predict weather changes far in advance. Brukkaros was selected for the experiments because of its clear, cool climate.

To Skim Ocean *at* 75 Miles *an* Hour

A MARVELOUS winged motor boat, called the *Sea Flea*, that skims over the water like a flying fish at seventy-five miles an hour, was built to attempt to cross the Atlantic from Marseilles to Pernambuco, South America. Launched in France, on its initial test it is said to have traveled sixty miles an hour between Marseilles and Algiers.

Up to thirty-six miles an hour, it ran like an ordinary motor boat. Then it began to rise off the water. At sixty miles, it hopped over the waves, its wings carrying it about sixty-five feet at a time. Despite its speed, its design called for a wing spread of only nine feet.



This Craft Skims Crest of the Waves

Two views of the novel and ingenious winged motor boat, the *Sea Flea*, recently built in France. Above is its bow, showing its airplane propeller and one of its wings. At right is the stern with hatch to cabin. Note the little boats at sides for balance. Its draft is only three inches

The Finest Lighthouse Station in the World

OUT on the farthest southwestern point of the United States in the Pacific, Uncle Sam is building the finest lighthouse station in the world. The new institution is so far removed from the old-time lighthouse that there is really no comparison except in that both have a light to guide mariners.

Point Vicente, Calif., is the rocky promontory on which the new station is being erected. When it is finished, the station will consist of a solid concrete, practically indestructible lighthouse; a fog signal station; a machine shop with every modern equipment for repair and upkeep of the machinery of the station; a twelve-room residence for the keeper; six-room residences for each of his assistants; a big garage; and a number of smaller buildings.

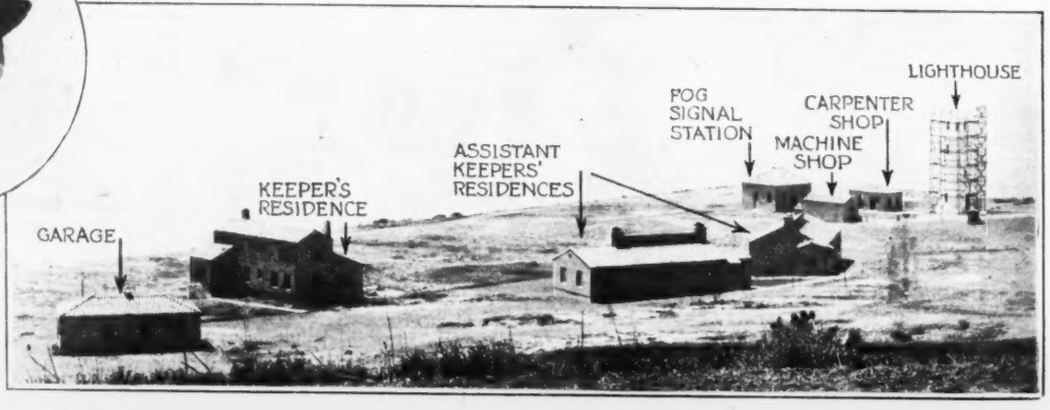
The most interesting feature of the station is the lighthouse. This building is the finest of its kind ever built. It is fifty-five feet high and is of solid reinforced concrete, resting on bedrock. The lamp is of the flashing electric type, and on a clear night it will be visible twenty-eight miles away. The lamp will give approximately 100,000 candlepower. Constructed atop a high bluff, the light will be 180 feet above the water.

The fog signal can be heard twelve miles away! It comprises two air compressors, each of twenty-two horsepower. Whenever the watch officer at the lighthouse station cannot see five miles out to sea, the horn is turned on. All the lighthouse keeper does is turn on an electric switch when he wants to have the horn function. A veteran of the Lighthouse Service, G. W. L'Hommedieu, will be in command of the new station.

The new lighthouse on Point Vicente, Calif., fifty-five feet high. Its light is to be seen twenty-eight miles at sea

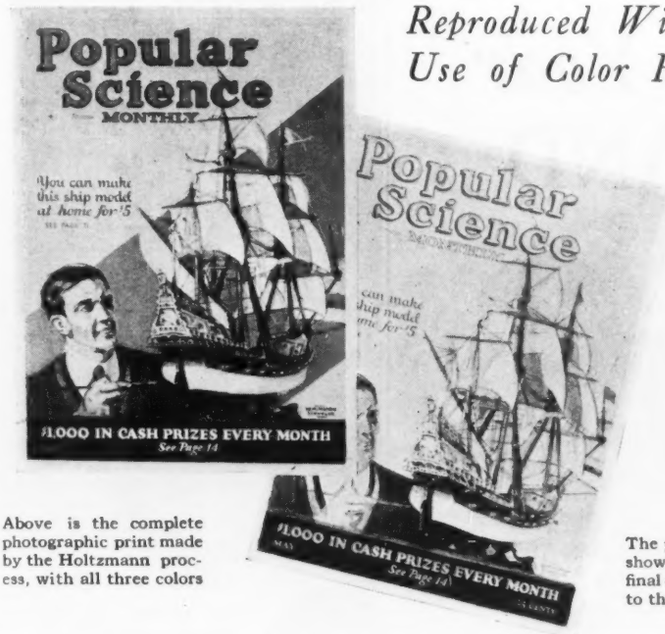
In Charge of Light

The veteran keeper, G. W. L'Hommedieu, head of the world's finest lighthouse station at Point Vicente, and the group of buildings belonging to the plant



Photographic Prints in Full Colors

Reproduced Without Use of Color Plates


Popular Science
MONTHLY
You can make this ship model at home for 5
$1000 IN CASH PRIZES EVERY MONTH
See Page 14
Popular Science
$1000 IN CASH PRIZES EVERY MONTH
See Page 14

Above is the complete photographic print made by the Holtzmann process, with all three colors

The picture at the left shows print before the final color, red, is added to the blue and yellow

Lewis Holtzmann, of Jersey City, N. J., inventor of new method for reproducing photoprints in colors, in his laboratory

IF A merchant wanted a few full-color photographs of some merchandise so his salesmen would not have to carry samples when calling on customers, he would have quite a job getting them at a reasonable price. The printer could supply him only after spending hundreds of dollars for special color plates to run off the prints desired.

The production of a few pictures in color on ordinary paper has been a problem that has long baffled scientists. The only way to get them has been by special color plates, using a different color of ink for each color in the object. Glass transparencies in full color have been known for some time, but they are not popular because they are heavy, easily broken, and must be held up to the light in order to see the picture.

Now Lewis Holtzmann, of Jersey City, N. J., has found a way to reproduce the colors in any photographic subject on ordinary paper.

Photographers have long known how to separate colors so that different negatives register the total amount of the primary colors. In fact, this process is widely used in preparing the plates for the colored illustrations in magazines and advertising circulars.

Holtzmann's process follows the same general lines until he has produced three negatives of the original; one for each of the three primary colors. He then sensitizes a piece of paper and proceeds to print photographically with light from one of the negatives. Then, taking the same print, he resensitizes it for another color which is printed on top of the first. The process is repeated for the third color. The finished print contains all the colors found in the original.

To demonstrate how perfectly he can make photographic prints in full color, Holtzmann made one of the cover of the May number of POPULAR SCIENCE MONTHLY, which is shown above in full colors and before the red had been added.

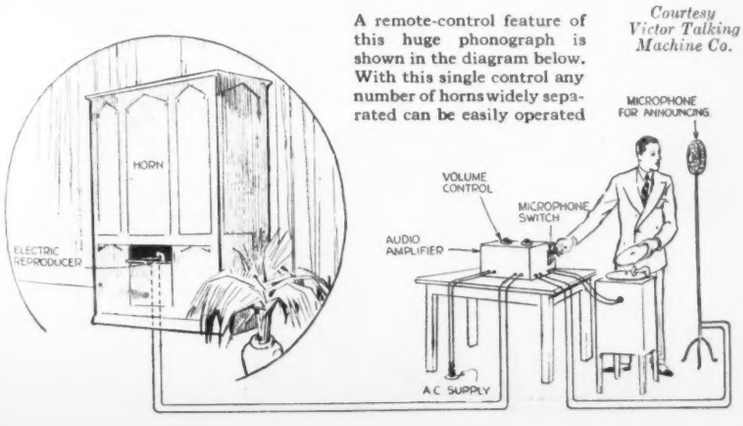
World's Largest Talking Machine

FOR great auditoriums, churches, theaters, hotels and other places where a large volume of tone is desired, the mammoth talking machine at the right, which plays an ordinary-sized record, has been recently built. Its huge horn, twenty feet long, is ingeniously folded so that the whole instrument is built into a cabinet about eight feet wide, four feet deep and eleven feet high.

The largest practical talking machine ever built, the new instrument can duplicate both the volume and quality of the music of a pipe organ, a whole orchestra, or complete band. In a recent out-of-door test, the voice of an opera star was heard clearly three blocks away, above the usual street noises. The instrument can be played either mechanically or electrically.

Courtesy Victor Talking Machine Co.

A remote-control feature of this huge phonograph is shown in the diagram below. With this single control any number of horns widely separated can be easily operated



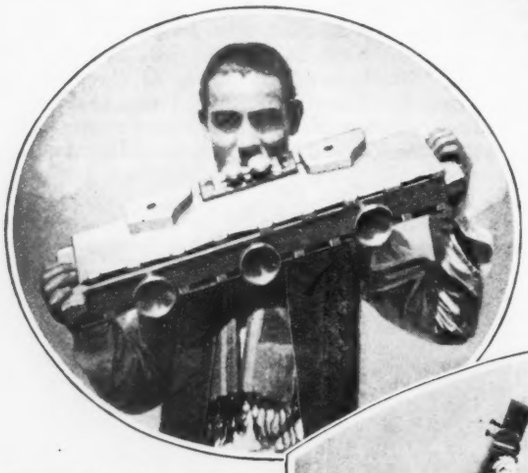
New Ones *for Your* BAND

Novel Use for a Beer Keg

We have had canned music for a long time. Now it comes in kegs. The fiddle, shown above with its designer, John Shreiner, of Portland, Ore., was made from a beer keg and a few pieces of wood. It is said to furnish just the right kind of music for the old-time dances

A Bamboo Violin

The unusual instrument, above, is called a bambolin. It is made from a single solid piece of bamboo, has strings like a violin, and is played with a violin bow. Its inventor, Juan Y. Billiones, a native of the Philippines, is shown with his instrument



Loudspeaker Aids Tone

A radio loudspeaker horn amplifies the tones of this unique one-string instrument, above, and makes it sound like a real violin. Violaphone is the name given it by its inventor, Joseph McCann, of New York City, who may be seen here playing on it

A One-Man Jazz Band

Here's the latest and largest in harmonicas. It was made by Carmon Ungero of Memphis, Tenn., and contains several mouth organs, bells, and jazz devices. It is said to sound like a whole jazz band when it is played. This unique homemade musical device is twenty-seven inches long and six inches wide

World's Oddest Band

At the right is the oddest jazz band in the world, it is claimed. A Siamese banjo, a Zulu tomtom and a genuine $75,000 Stradivarius violin, played by assistants of the Carnegie Museum, Pittsburgh. The instruments were borrowed from the museum's collection, and are said to produce a fearfully wonderful type of jazz music rarely heard

Half-Brother to a Hawaiian Guitar

Jazzitha is the name of this queer, jazzy little one-string half-brother to the Hawaiian guitar. It is played with a pick and bar just like a regular guitar. Music for it is written in numbers with dots to indicate the time. Numbers on the finger board where the string is to be held by the bar correspond to the music. Its maker claims it is easy to learn to play

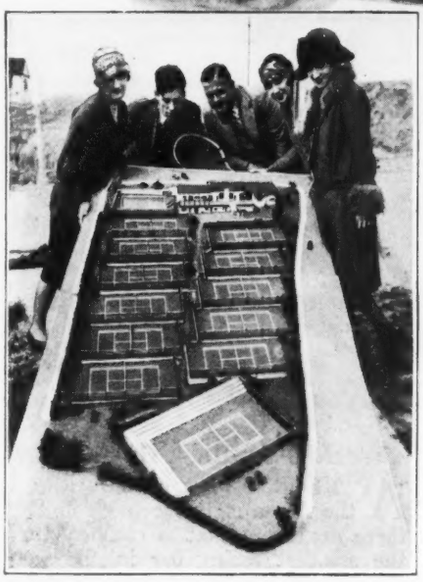
Models *Make Real* What Maps Fail to Tell

An Old City in Miniature

The model above is a reproduction of St. Augustine, Fla., which gives a better idea of the old Spanish city than a map or picture could. This model is sixty feet long and about twenty-four feet wide

ONCE, when a person wanted to know what a city was like, he had to consult a flat map. Now he can see it just as it is in a small model which is an exact replica in every particular. To get an idea of how a new building was going to look when completed, you had to consult drawings, plans and blueprints. These might help you, if you were good at visualizing. But now you can be sure. You can see it exactly as it will be, in a little model, perfect to the last detail.

All kinds of projects are shown today in these small models, which are growing more popular every day. Architects are using them to display their buildings. Sculptors employ them to present their ideas for statues and monuments. Real estate promoters find them useful in booming their property. Some enterprising builders are making small replicas of their houses for prospective buyers.

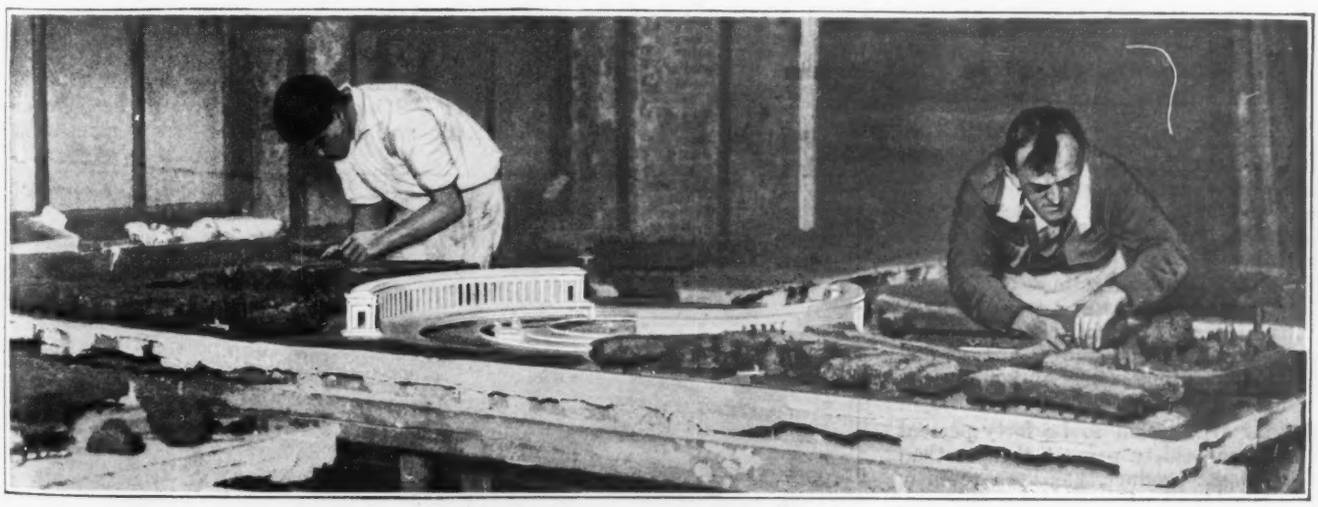


They Wish It Were Ready

These members of the Palomar Tennis Club of Los Angeles, above, can tell just how their new $225,000 courts and clubhouse will soon look from the working model they are inspecting

No Detail Is Neglected

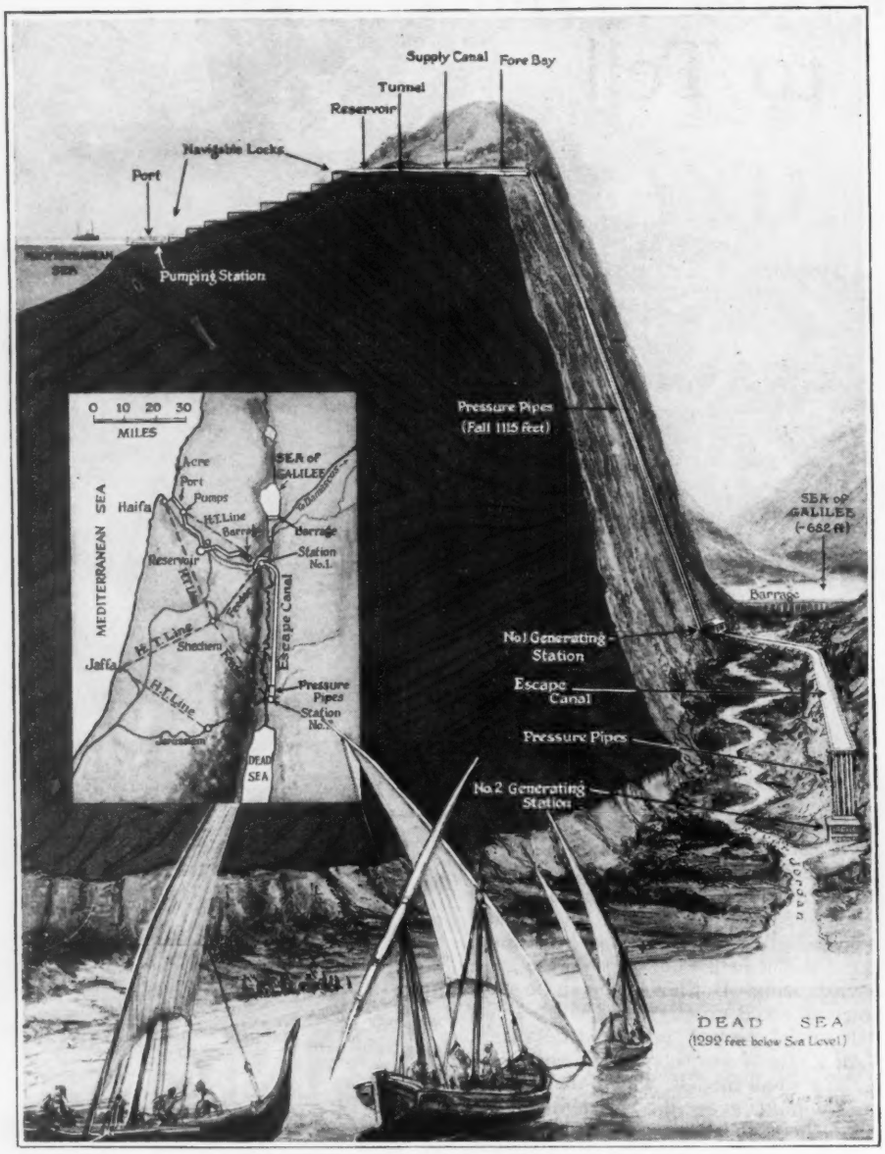
A close-up of one of the girls engaged in building the model of St. Augustine, Fla. The illustration shows her painting a miniature clubhouse



How the Roosevelt Memorial Will Look

This interesting plaster model shows the completed appearance of the proposed Roosevelt memorial, designed by John Russell Pope, the noted American sculptor, to be erected at Washington, D. C. The colonnades and the circular pool in which they are reflected are faithfully reproduced

Amazing Plan to Pour Mediterranean into Dead Sea



Tapping the Sea to Get Electricity for Palestine

Drawing shows how M. Imbeaux, an engineer, makes the Mediterranean supply power for the Holy Land by carrying it into the Dead Sea. Insert, diagram of proposed scheme

AN INGENIOUS plan to provide electric power for Palestine, devised by M. Imbeaux, a French engineer, is illustrated in the drawing at the left. By electrically operated pumps, M. Imbeaux would bring the waters of the Mediterranean up to a reservoir to be built on the top of the ridge of highlands that separate the valley of the Jordan from the coast. From this reservoir the water would then be made to flow into a great basin just above the valley of the Nahr Djaloud, a tributary of the river Jordan. Thence it would fall a distance of 1115 feet to a hydroelectric generating station. Passing through this station, it would be carried in pipes to a second station, and thence to the Dead Sea.

The surplus water in the Dead Sea would be taken care of, it is claimed, by evaporation, which at present carries off daily as much water as the river Jordan pours into it, nearly two billion gallons.

The plan also calls for the enlarging of the port of Haifa, and a series of locks as shown in the diagram.

World's Smallest Racing Car

AT RECENT automobile races on the Argenteuil race track in Paris, there appeared what is claimed to be the smallest racing car in the world, shown in the picture above. It is light but sturdily built, and has a powerful little engine. It just holds the driver.

MONTANA produces more high-grade manganese ore, used in the making of steel, than any other state in the Union.

New Engine Hauls 125 Cars

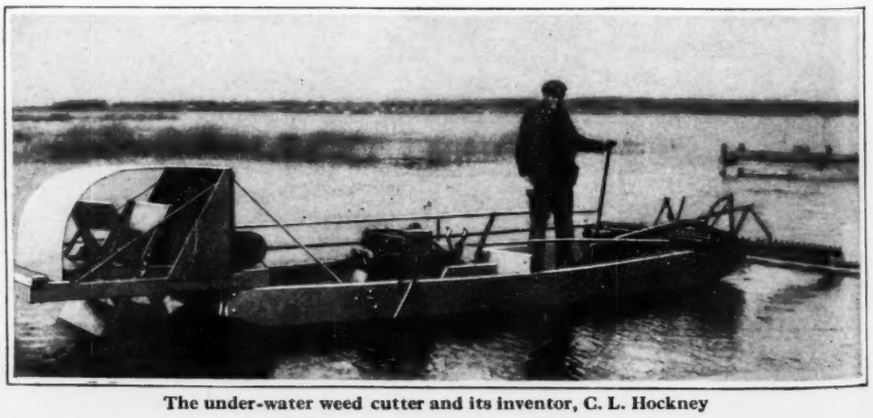
AN ENTIRELY new type of freight locomotive, having three cylinders and capable of hauling 125 cars across the Rocky mountains at the rate of fifty miles an hour, was recently put in commission by the Union Pacific Railroad. It is the first to have three cylinders in combination with six pairs of drive wheels. It is 102 feet long and weighs 782,000 pounds. Its cost was $105,000. It is sixteen feet high, seven feet wide, carries 15,000 gallons of water, and consumes six tons of coal an hour.

A NEW STEEL, said to be forty percent lighter and thirty percent cheaper than the present product, has been recently developed by the Swiss engineer, Boshard, of Zurich. Experts who tested it at the Zurich Polytechnicum and at Dresden are said to have recommended it highly.

Under-Water Sickle Clears Water of Weeds

TO KEEP rivers, lakes and ponds clear of weeds that seriously interfere with boating, fishing, and bathing in the summer, and spoil the ice crop in winter, C. L. Hockney, of Silver Lake, Wis., has invented the under-water weed cutter below. A sickle attached to a motor boat cuts a ten-foot swath as it is drawn along. Side sickles prevent clogging or winding up of floating weeds.

One man can operate the machine, and can easily clear twenty acres a day.



The under-water weed cutter and its inventor, C. L. Hockney

Novel Restaurant Has Revolving Counter

IN SAN DIEGO, Calif., is a restaurant called the Banquet Cafe. Its window bears the invitation to come in and consume "All You Can Eat and Drink." Inside, the lunch counter is apparently ordinary in all respects except that it is circular. But you soon discover it is decidedly out of the ordinary. Around its inner edge is a revolving circle of wood which moves clockwise on rollers. The photo at the right shows it in operation.

Seated at the counter, a waitress serves you with butter, water, a bowl of soup and silverware. Thereafter you look out for yourself. Past you rolls an assortment of meats, vegetables, salads and desserts. You help yourself to them. "Take as much as you can eat," the proprietress urges. "See! The moving circle runs through the kitchen. The cook will fill them up again."

The interior of San Diego restaurant showing unique revolving counter

Better Welding Achieved by Two New Methods

AFTER years of research, it is now possible to weld two metals together so that the fused metal is as strong and ductile as if it were never in two pieces. Two new processes that achieve this result were recently developed at the research laboratories of the General Electric Company, one at Schenectady, N. Y., and the other at West Lynn, Mass.

With previous methods utilizing an electric arc to furnish the necessary heat, compounds of the metals with oxygen and nitrogen were formed, and the weld was not so strong as the rest of the piece. Both the new processes are based on the exclusion of air from the metal during the welding, since the oxygen and nitrogen which unite with the metal come from the air. This is accomplished by a bath of hydrogen, water gas, wood alcohol vapor, and other gases that do not easily form metallic compounds.

Detachable Spikes for Golf

FOR golfers, spikes that clamp on like skates, shown below, change any shoes into golfing shoes. They can be used, too, by hikers, hunters, or workmen who need a firm grip on smooth or slippery surfaces.

The plates are adjustable to any size of shoes. They are easily detached, and may be carried in the pocket.

EIGHT DISTINCT species of parasites have been imported from Europe to prey upon gypsy moths in an effort to check the ravages of those pests in New England.

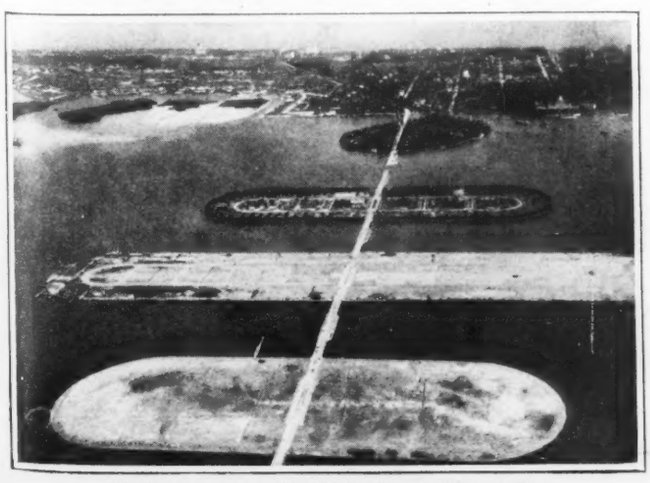
Nests Attract Bumblebees

READY-MADE nests for bumblebees, set up in various parts of the field, is a worth-while investment for clover raisers, according to a recent statement by Dr. Theodore H. Frison of the Illinois State Natural History Survey. If a house is waiting for her, he says, a queen bee may move in and start a colony, to the owner's profit.

Bumblebees alighting on clover blossoms carry pollen away and thus allow the seed free to develop. They are the farmer's best hired men, and he can afford to provide them with homes. Dr. Frison succeeded in getting tenants for half of the artificial nests that he set.

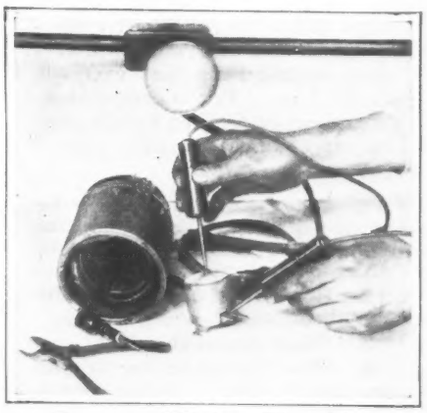
Islands Made to Order on Florida Coast

THERE'S not enough of Florida to go around, so they're making more of it daily, taking it out of the sea. If you have sufficient money, you can order an island all your own, and in an amazingly short time you can begin building your house on it.



Airplane view of artificial islands near Miami, Fla.

The exceptionally fine airplane photograph at the left shows three marvelous manufactured islands near Miami. They were pumped out of the bottom of Biscayne Bay. Crossing them is a new causeway to Miami Beach, which is seen in the distance. To make these islands, piles were driven in the water and then silt was piped in the enclosures. Any shape of island desired can be made.

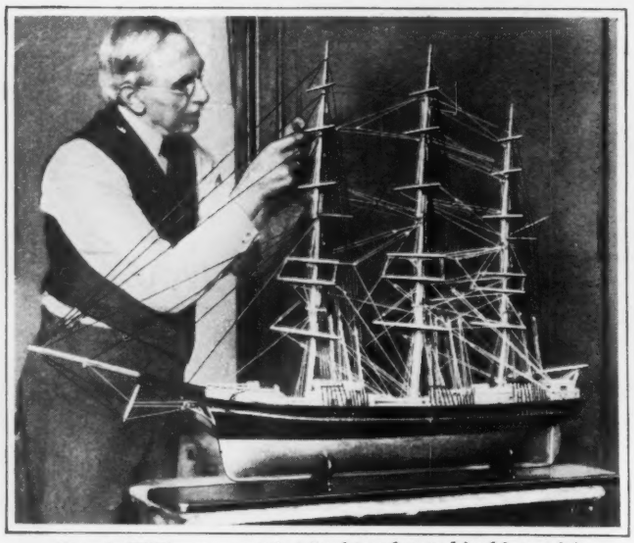


Locates Wiring Troubles

A COMPACT one-pound trouble shooter, which can be operated from any lamp socket, may be seen above. It has been devised for home use, to help you find what is wrong with your radio, automobile, flat iron, or any other electrical apparatus. It can be used to locate short, grounded or open circuits, and to detect loose connections. With a rectifier, it can be used to charge B-batteries.

Shock-proof handles protect the user from shock, and the device is designed with a special socket that insures against fuse blow-outs. It is also heat-proof.

Captain Builds Model of Ship He Sailed



Captain Williamson putting final touches to his ship model

THOSE were wonderful days not so many years ago, when great sailing vessels were queens of the seas. There was adventure and romance aplenty then. Captain Frederick Williamson of the Sailors' Snug Harbor, home for veteran seamen on Staten Island, N. Y., loves to recall them by building models of ships of those days. In the picture at the left, the captain is seen finishing a fine model of the *Governor Robert* which he sailed forty years ago.

LONDON DOCTORS are puzzled by the experience of ex-Sergeant Frederick George Lee, one of the blood supply men of the Middlesex Hospital. In the last three years he has given blood to twenty-four patients. Seven of them have died, and, although Lee had never seen any of them, at the exact moment of their deaths he is said to have felt severe pains in his arm and to have become sick.

How Much Do YOU Know about Science?

YOU may perhaps know a good deal about nature and her daily wonders. But do you know all that well-informed persons should? Here is a good test of your knowledge. Below we print twelve questions that deal with common, everyday, natural facts that everyone should know. Try to answer them from memory. Then turn to page 127 and see how nearly correct your answers were.

1. Why can more notes be produced on a violin, which has only four strings, than on a piano, which has many?

2. How are the joints of the body lubricated?

3. What causes the tides?

4. Why do seeds lie in the ground all winter and then sprout in spring?

5. What is meant by pasteurized milk?

6. How does heat get to us from the sun?

7. Why is yawning catching?

8. What is liquid air used for?

9. How is limestone produced by living creatures?

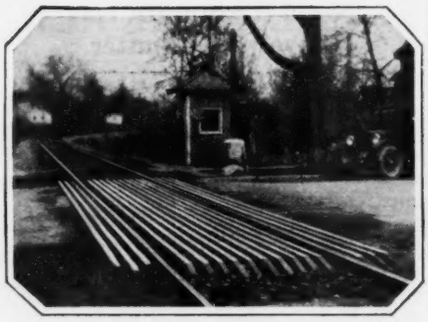
10. How can the weight of a large ship be determined without taking it out of the water?

11. Why is there light in daytime even when the sun is hidden?

12. How can desert travelers tell a mirage from a real lake?

A Non-Skid Shoe for Bowlers

DURING a bowling match, the soles of the shoes often become slippery and slow up a player's game considerably, making him miss easy shots. To overcome this difficulty, a special overshoe for bowlers has been devised by a Highland Park, Mich., lover of the game. It is made of soft leather and is shaped like a moccasin. It fits tightly over the sole of the shoe and is held firmly by a thong that runs through eyelets. The shoes can easily be rolled up and carried in the pocket.



Grade Crossings of Old Rails Put an End to Bumps

THE old-fashioned plank crossing at the intersections of railroads and highways will soon give place, it is said, to a new type recently developed by a mid-west railroad. The new crossing, shown above, is constructed of discarded steel rails, placed closely together and embedded in a mixture of asphalt and crushed rock, after first being spiked to heavy timbers instead of the usual ties. The ends of the rails are bent downward a distance of about eighteen inches back from the end.

The new crossings are smooth, and the upkeep is said to be much less than for plank crossings, which work loose and become bumpy after a few months' use. The designers claim they will wear for years and will not loosen, as they rise and fall with the rails used by the trains.

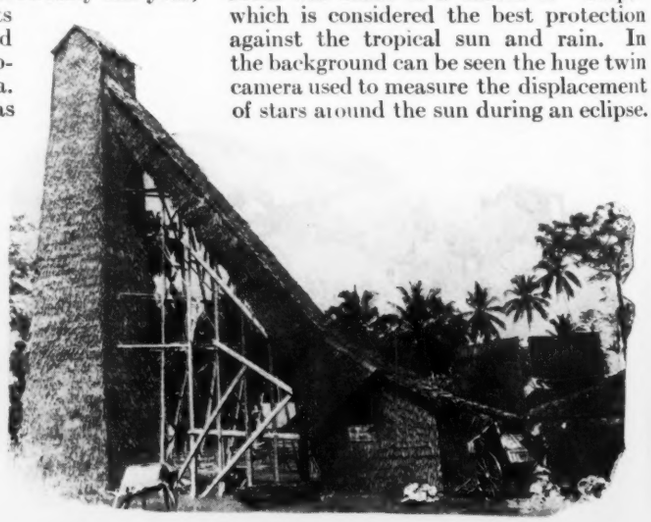
To Have an Indian Village

AN INDIAN garden and village are soon to be erected in the Bronx, New York City, as part of the Museum of the American Indian. The first wing to be built will contain a museum of Indian relics. When the whole building is completed, the open patio in the center will be occupied by a botanical garden of plants used by North American Indians as food and as medicine. Full-size models of Indian dwellings will also be constructed to give a good idea of Indian home life.

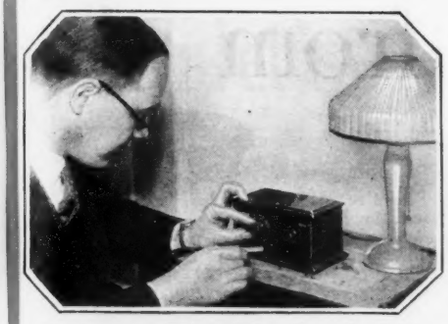
Huge Eclipse Camera Protected by Thatch

TO BE ready for the total eclipse of the sun that occurred early this year, groups of scientists from all over the world spent months of preparation in Sumatra. Much of this time was spent in setting up and building shelters for their delicate instruments from the glaring sun and torrential rains of the tropics. The photograph shows how the Swarthmore College expedition protected its giant 63-foot camera that played an important part in making pictorial records of all stages of the eclipse.

The covering of the tower, the telescope tube and the dark room was made of a thatch of "atop," which is considered the best protection against the tropical sun and rain. In the background can be seen the huge twin camera used to measure the displacement of stars around the sun during an eclipse.



The giant 63-foot camera of the Swarthmore College eclipse expedition in Sumatra, covered with thatch to protect it from sun and rain



Cigarette Humidor Looks Like Small Radio Cabinet

TUNE-IN and get a cigarette. Turning the dial to either the right or left in this novel humidor, which is built to resemble a radio cabinet, brings a cigarette tumbling forth. It is large enough to hold 100 cigarettes.

The interior of this radio cigarette box is divided into two compartments. The one to the right holds the cigarettes, while the one at the left contains the mechanism connected with the dialing system.

A New Oil from Grape Seeds

FRENCH scientists have discovered a new use for grape seeds. They are extracting a lubricating oil from them. As soon as the grapes have been pressed, the seeds are removed from the skins and dried. They are then subjected to a process for removing their oil.

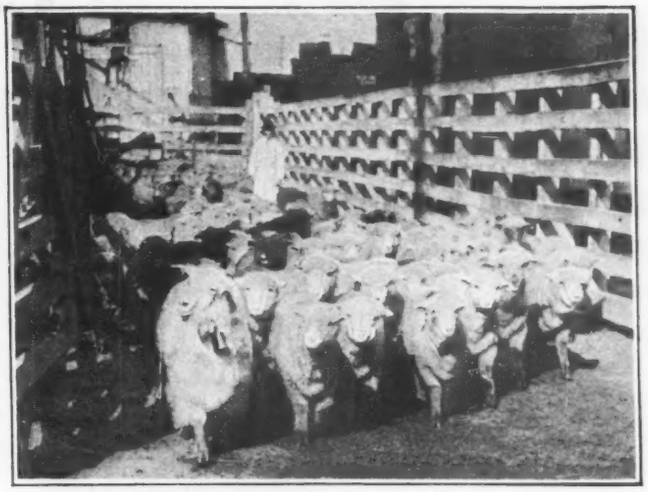
A thousand kilograms of grape husks give about 230 kilograms of seeds, from which about twenty-seven kilograms of oil are obtained. The residue is used for fertilizer.

With this new oil, French engineers hope to replace castor oil, which it resembles, as a lubricant for delicate motors, especially of airplanes. Castor oil is expensive, being imported from India, while the new oil is comparatively cheap and equally efficient. Already factories have been established in many wine districts of France with a capacity for handling thousands of tons a year, and a new industry is developing.

Goat Leads Sheep to Their Slaughter

JUDAS, a California Angora goat, deserves his name. He has betrayed 250,000 sheep in his time, leading them to their deaths in the slaughter yards.

So unwary are sheep that, when Judas leads, they confidently follow him, never to return. Judas is kept busy on slaughtering days. In the photograph he is seen being followed by a flock of witless sheep to the killing pens of a Los Angeles packing plant.



Judas leading sheep to killing pens of slaughterhouse

Puts Out Fire without Liquid

SHUTTING off the air will stop a fire at once, and any apparatus designed to do this is vitally important to the fireman. In a new design of fire extinguisher, shown at the left, there is no liquid. A combination of powder and carbonic gas is used instead.

When the cone-shaped powder holder is turned upside down and a valve on the gas cylinder turned, a blanket is formed over the fire. This cuts off the oxygen supply and prevents further combustion. It develops no fumes to hamper the person using it, and is said to put out all types of fires. When not in use, the extinguisher is held in a bracket on the wall in some easily accessible place.

RAIN GOING up instead of down is the interesting spectacle witnessed by a man in a captive balloon in the midst of a summer thunderstorm.

Chinese Have New Typewriter

A TYPEWRITER that is said to be capable of transcribing 5,000 Chinese ideographic signs, designed by a native of Shanghai, has been recently put on the market in China. It is claimed that with two months' practice an educated Chinaman can acquire a speed of 2,000 characters an hour. The entire apparatus weighs about forty pounds.

This Mystery Automobile Runs on Air

THIS inventor has the right idea. Lee Barton Williams, of Pittsburgh, Pa., has invented an automobile which, he claims, runs on air. The motor starts on gasoline, but after it has reached a speed of ten miles an hour the gasoline supply is shut off and the air starts to work.

In its first test, made recently in Pittsburgh, the strange vehicle attained a speed of sixty-two miles an hour. The inventor for the present refuses to explain how air makes the wheels go round. Thousands of automobile owners who are paying out considerable sums every week for motor fuel will watch the further development of this curiosity-provoking mystery car with hopeful interest.

Lee Barton Williams, Pittsburgh inventor, and his automobile that he claims runs on air, after it gets up a speed of ten miles an hour. It recently attained 62 miles an hour

KNOW YOUR CAR

AUTOMOBILE engineers say that the majority of cars that fail to give efficient service have been ruined by careless driving in the first thousand miles. Like a new pair of shoes, a new car must be "broken in," otherwise trouble is almost certain to develop.

A new car is "stiff"; the various moving parts have not yet accommodated themselves to one another, and the car will not function perfectly until after there has been a certain amount of wear between these parts.

Too fast driving when the car is new will cause, among other things, excessive wear between these parts, and the harm is likely to be irreparable.

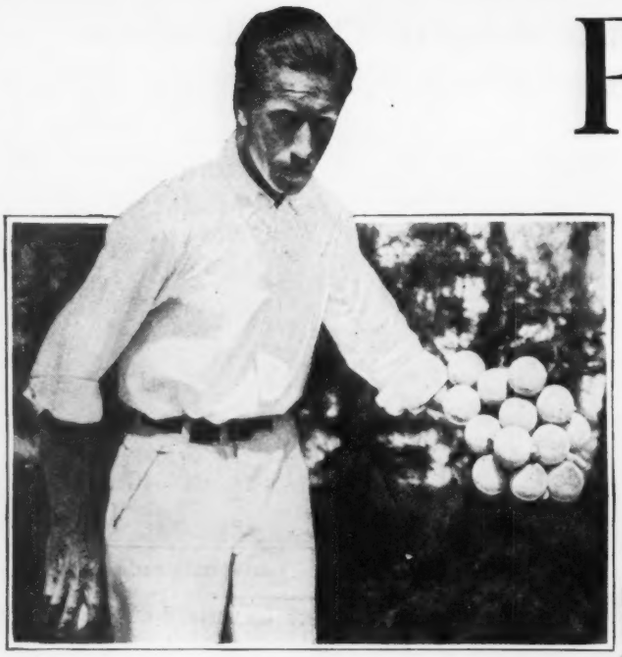
To break in your new car:

1. For the first thousand miles, drive at a speed of twenty-five miles an hour, or less.

2. Take full advantage of the service offered by your dealer, or, if no service is offered, have your car inspected periodically during the first thousand miles by a competent mechanic.

3. Make sure that the car is kept thoroughly greased and oiled, and stop and investigate at once if the motor appears to be overheating or if any peculiar noises are heard.

Pages from the



Thirteen to a Hand

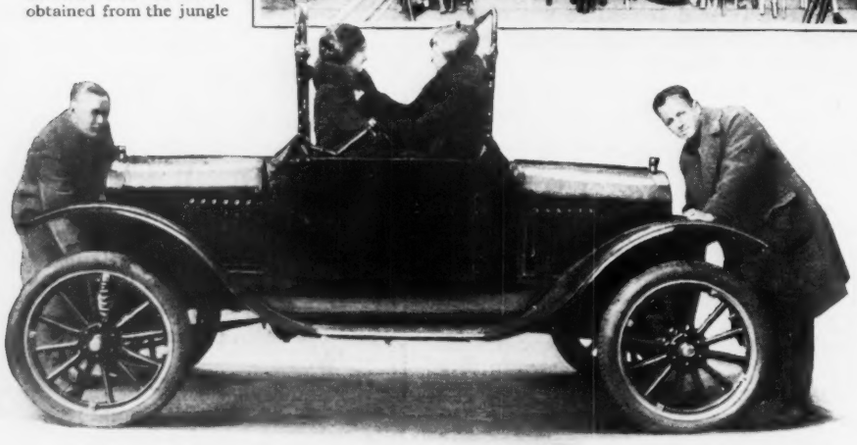
Holding thirteen tennis balls flat in one hand is a record George Agutter, above, a professional tennis player, claims gives him one world championship. Another, he thinks, belongs to him for holding nine balls in one hand while serving a ball with the other hand

Fire Day in the School

None of the children miss school the day Harry K. Rogers and his fascinating model of a real fire engine, right, are scheduled to appear. He shows them how to prevent fires and what to do when one is discovered. All over the country this safety engineer is lecturing to children in a campaign to reduce the tremendous daily fire loss occurring in the United States

The World in Canes

On a recent trip around the world, Emil C. Kischel, of Minneapolis, Minn., bought a cane every place he stopped. The result is the collection shown at the right. It consists of all kinds and shapes, from artistic inlaid creations to crude, twisted tree branches obtained from the jungle



Foiling the Smoke Clouds

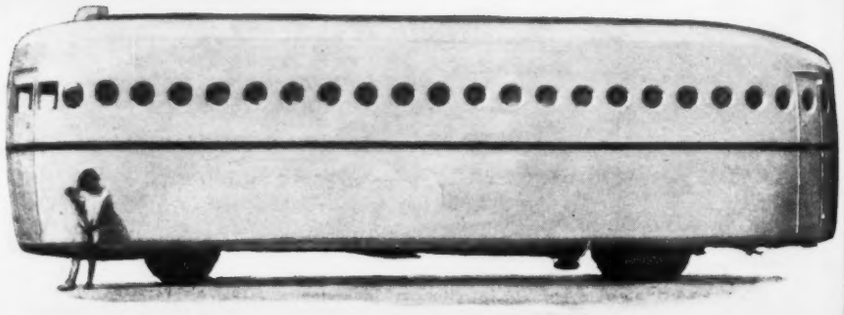
To reach the Chicago weather bureau tower, Edward Lawler, assistant weather forecaster, above, has to wear this leather suit and gas mask as a protection from smoke and soot. The tower is directly above a huge smokestack

The Siamese Twins of Flivvers

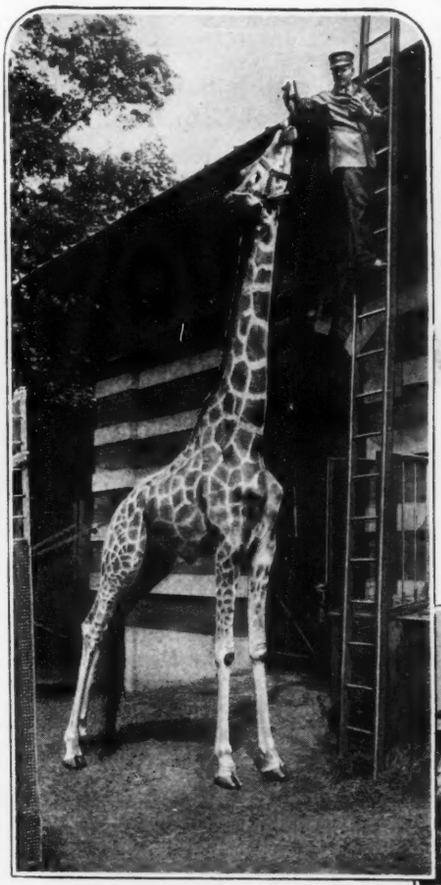
By looking quickly at this double-headed flivver you can't tell which is the front or the back. They both look alike. With two drivers and two men ready to crank it, the effect is mystifying. This puzzler has been used recently for advertising purposes by a Somerville, Mass., company

An Eight-Room Flat on Wheels

The car at the right looks like the cabin of a huge dirigible, but in reality it's a motor flat of eight rooms with kitchenette and bath. It was built by Charles Louvel, a French inventor, and has just recently appeared on the streets of Nice, France



World's Scrapbook



Measuring a Giraffe

Here's how they measure giraffes at the Zoological Park, New York. A keeper on a ladder holds out food. As the giraffe reaches for it, its height is measured by the ladder rungs, which are exactly one foot apart. This giraffe is seventeen feet from hoof to tongue tip

Rowing through the Streets

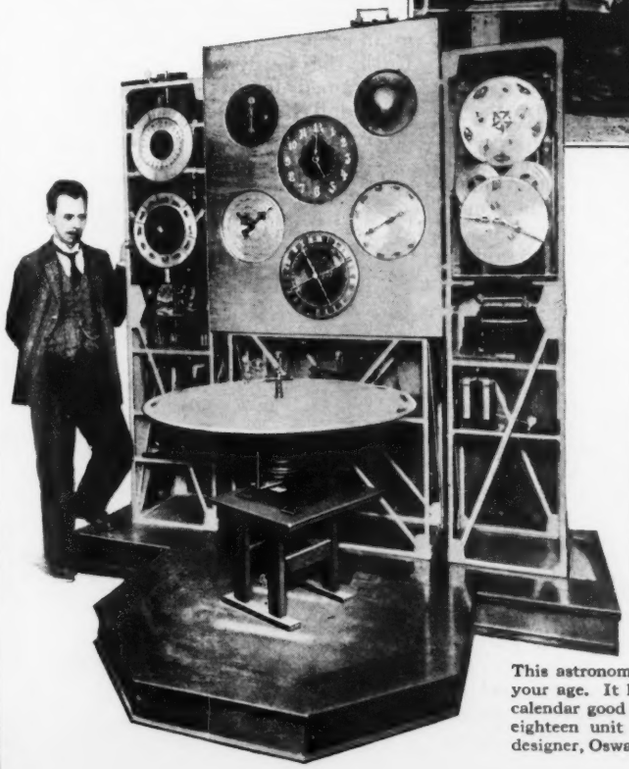
Above is a novel land skiff invented by Dr. Curry, a medical student in Munich, Germany. A rowing motion with handlebars makes it go. It is made of duralumin, and is very light and speedy. It can be propelled at a speed of eighteen miles an hour

Bigger Than a Man

The Great Dane pictured above had the distinction of being the largest of 1,138 dogs at a recent exhibition in Chicago. On all fours he measures 33½ inches high over the shoulder. On his hind legs he is taller than an average man. He weighs 176 pounds

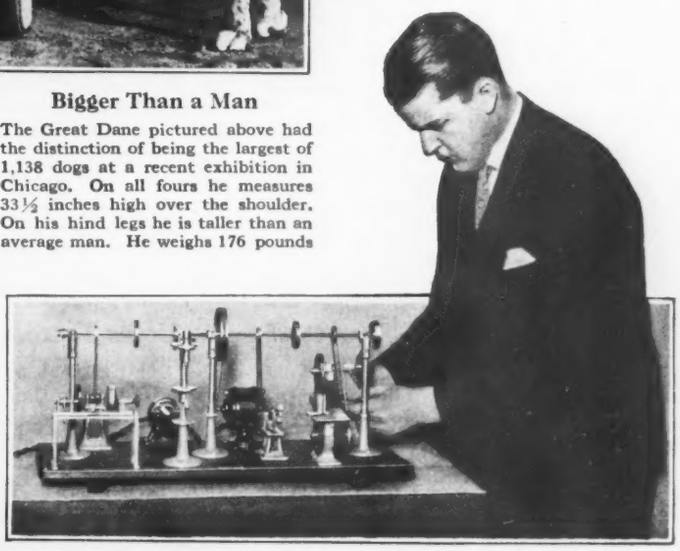
His Claim to Fame

The champion spaghetti eater is the title Marco Modugno of Los Angeles claims. He boasts a record of 138 miles of spaghetti at a sitting. He eats it four times a day. Above is just a mouthful



Clock Has 468 Wheels

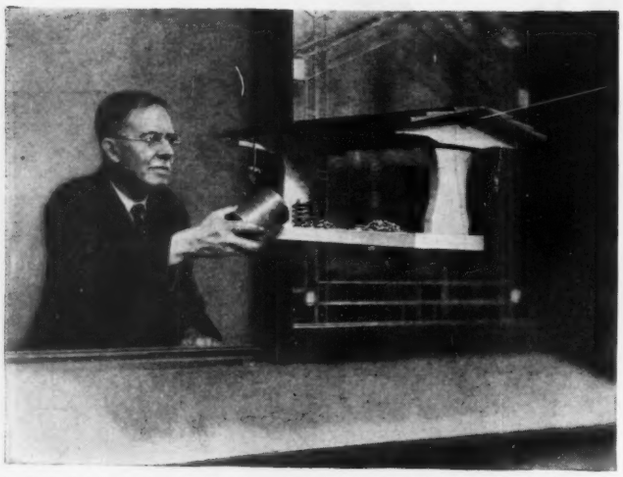
This astronomical clock, left, tells everything but your age. It has twelve dials for the time, and a calendar good for 15,000 years. This creation has eighteen unit works containing 468 wheels. Its designer, Oswald Schultz, of Berlin, stands beside it



A Tiny Machine Shop

One of the most interesting exhibits at the National Toy Fair in New York City was this toy, said to be the smallest working machine shop in the world. It is run by electricity

Novel Car Brings Birds Food and Shelter



Stocking bird-feeding car at window without leaving house

TO FEED the birds from the house, the little car, left, which works back and forth on a cable, has been designed. Stocked with food at the window, it runs to the other end of the line, under the trees, where the birds gather. It is drawn back by a rope. It contains a drinking cup, wire feeding rack, food hopper and suet hook. It has also a roof to shelter its guests. The little car is a boon for the birds in bad weather.

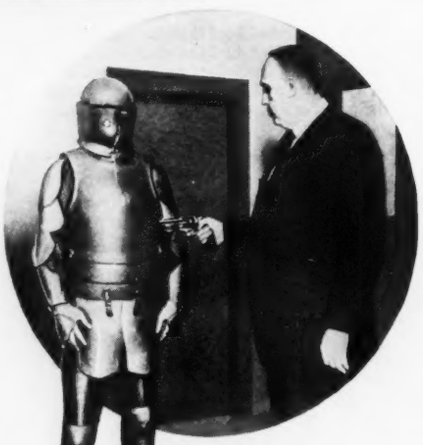
Ingenious Windmill Supplies Farm with Electricity

ELECTRICITY taken from the air supplies a farm in Anderson, Ind., with light and power practically without cost. During the dull winter months, C. E. Miller and W. T. Miller, with the aid of an electrician, William Maze, made the machine illustrated below, which the inventors claim is entirely automatic and generates electricity any time that there is a fair breeze.

Twenty-four propeller blades are hinged to one side and are held in proper position with a brass coil spring which is adjusted to yield under excessive wind. This governs the speed of the wheel and makes it safe to weather storms.

A cone point heads into the wind and utilizes power, ordinarily lost, by spreading the wind and forcing it through the blades. A rim a foot wide keeps the air from slipping over the ends of the blades, thus giving more power and stiffening the wheel. The tail-like device below the generator swings back and forth with the wind and operates a part of the electrical mechanism causing the generator to make current in quantities—according to the velocity of the wind. A strong wind generates electricity to the full capacity of the generator.

A specially built belt, made from automobile fabric and covered with rubber, transmits power to the generator. The electricity generated is stored in a large battery which will carry a sufficient quantity for light and other purposes for a period of about two weeks should there be no breeze in that time. The machine operates as quietly as an electric fan.



A Chicago policeman wearing bullet-proof armor designed as protection against the attacks of holdup men

Armor to Protect Policemen from Bandits' Attacks

CHICAGO policemen may soon look like knights of old, if the heads of the department decide to adopt the metal armor shown above, which has been under consideration for some time. It was manufactured by a Boston firm, and was designed to protect the police from the attacks of the modern holdup man. According to its manufacturers, the armor is absolutely bullet-proof, and will withstand the worst gun fire. It is also said to be neither very heavy nor cumbersome, and does not interfere with the wearer's movements. The helmet has an adjustable visor which can be raised.

Urges Tattooing of Pigs

IN ORDER that pigs may be readily identified after slaughter, and disputes as to ownership avoided in cooperative marketing, the United States Department of Agriculture urges farmers to tattoo their pigs.

A new method of tattooing, said to be inexpensive, employs a metal holder in which phonograph needles are imbedded to form initials or numbers. The needles are dipped in black automobile enamel, and the mark is put on by striking the pig across the back with them.

Convertible Saw Frame Has Pistol Grip Handle

AN UNUSUAL, recently designed saw frame that has a pistol handle grip and can be used with many sizes of blades, is said to save time on jobs where it is hard to get at the work. A gap between the blade and the handle enables the user to reach around obstructions with it, and to saw in close quarters wherever a two-inch stroke can be made.

Blades from three to twelve inches can be used in this noncollapsible, convertible frame. Carpenters and electricians, the designer claims, will find it useful in sawing on the other side of joists, auto mechanics for reaching behind pipes, and others to do awkward sawing jobs.

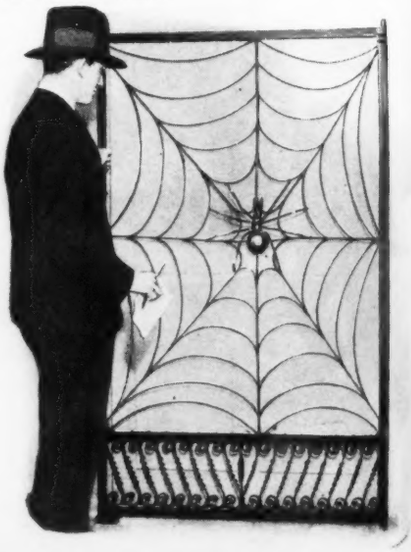
Navy Develops New Engine

A TWO-CYLINDER aircraft engine employing heavy oil has been developed by the Navy Department, and, if it proves as successful as tests seem to promise, a more powerful engine of the same type will be constructed. The new engine, invented by A. P. Attendu, is said to be of special value for dirigibles because its fuel is nearly noninflammable. It weighs 3½ pounds per h. p.

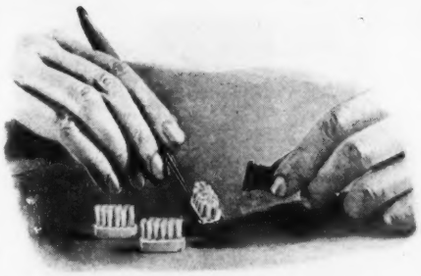
A Spider's Web Iron Gate

SO BEAUTIFUL are most of nature's designs that our craftsmen can do no better than to copy them. Nothing one could imagine for himself could be more wonderful, for instance, than the intricate spider's web. The illustration below shows how this has been used for the delicate design of a hand-wrought iron door.

This was one of the most striking pieces at an exhibition recently held in London. Until the fourteenth century England was famed for its hand-wrought iron work, and efforts are being made today to revive the craft.



Hand-wrought iron gate with spider web design recently shown in London



Novel Type of Toothbrush Has Detachable Handle

A NOVEL idea in toothbrushes is illustrated above. It consists of a metal holder to which are fitted small brushes that can be removed when worn out and replaced with new ones. The brushes are tightly locked into the holder with a key, and cannot loosen or fall out. They are said to be made of a good quality of bristles, and a number of refills are supplied with each handle. A metal cover slips over the brush when it is not in use, and keeps the dust out. The new brush is claimed to outlast the ordinary toothbrush that is now in general use.

A TELESCOPE-CAMERA has been devised recently by Professor Clinton H. Currier of Brown University to photograph meteors. This camera is operated by clockwork, and the instrument covers sixty-four square degrees of the heavens.

Painting May Be Done Quickly with Portable Sprayer

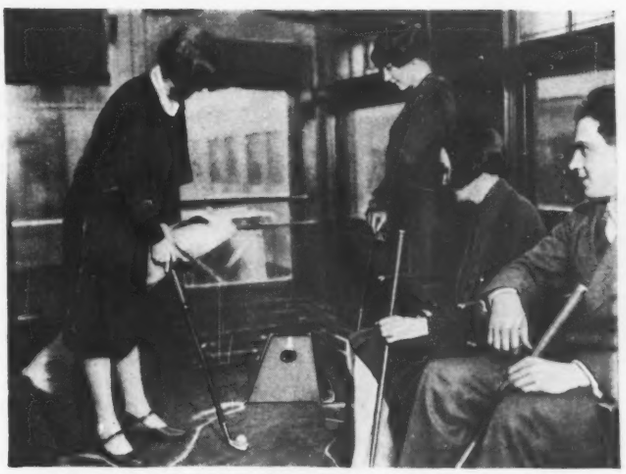
CLEANING and brightening up the shop with paint may be done quickly with the portable blower and sprayer which is shown below. It consists of a heavy duty compressor run by electricity, a fifteen-gallon tank, a spray gun, and twenty-five feet of hose mounted on a steel truck.

This portable machine can be used for painting automobiles, walls, furniture, or machinery. It may also be employed for cleaning printing presses and other machinery and for blowing dust and scraps out of places that are difficult to reach with a broom or brush. In garages it can be used for cleaning engines, upholstery, for valve grinding and for inflating tires.

Giving the factory wall a coat of paint with a new and convenient type of portable sprayer

A Golf School on Wheels for Tourists

RAIN or shine, Chicago golf fans on a trip by train to the South recently had their daily practice, under professional coaching. A putting course was laid out in a parlor car and a tournament held, as seen in the picture at the right. Driving nets were set up in a baggage car. The "Training Trip Tourists" was the name given themselves by the 100 enthusiasts who made up the party.



Learning fine points of game in first golf school on wheels

Brush and Mirror Combination

A BRUSH to keep the hair neat, a mirror to see whether the part is straight, both contained in one compact case, comprise a late novelty that many persons have found useful. It is small enough to slip in the pocket ready for instant use.

The mirror is on the under side of the lid. Pressure on the case removes the brush so that both mirror and brush can be used at the same time. The case is of aluminum, and the brush has stiff black bristles set in rubber.

New Dye for Photographing Infra-Red Rays

A NEW dye called neocyanin, which may prove extremely valuable to astronomers in photographing the hitherto invisible infra-red rays, has been developed recently by a great American photographic concern. The ordinary photographic plate is sensitive only to blue light and the shorter invisible ultra-violet rays. It can, however, be sensitized to other colors by the use of dyes. The new dye makes them sensitive to light waves of 1/22,000 of an inch, while the longest rays visible to the naked eye are 1/30,000 of an inch.

Plates treated with the new dye may prove a great aid to spectroscopy, for the spectroscope shows light and dark lines in the invisible infra-red region of stars, which hitherto the astronomer was unable to distinguish clearly.

Color Blindness Hereditary?

COLOR blindness, as recent studies seem to indicate, is hereditary and due to a defect in the central nervous system. It occurs oftener among boys and men than among girls and women, but in boys it is frequently only color ignorance, rather than an inherent defect. As a corrective, special attention is now being given in the public schools to developing a color sense among all the pupils. Statistics show that color-blind men do not transmit this defect to their daughters, but through their daughters it is passed on to half of their male grandchildren. Boys inherit this defect only from their mothers, as is said to be usual in heredity.

Hot Air Towels for Drying Your Face and Hands

JUST as tin drinking cups have given way to modern sanitary drinking fountains, so, it is confidently predicted, the paper or cloth towel is destined to be thrown in the discard by the new machine, shown at the right, that dries the face and hands quickly by electrically heated air. Pressing a button turns on the current, and the hot air pours out through a nozzle.

This new way is said to be absolutely sanitary. There is no danger of infection as with towels, and it prevents chapping and leaves the skin smooth. Besides doing away with the waste and nuisance of towels, and the muss and untidiness of wash rooms, its use is far more economical than cloth or paper towels. The cost of upkeep is said to be three quarters less.

The new machine is being installed in many factories, clubs, hotels and stores.

Steel Closets Designed for Apartments

A moth-proof and moisture-proof closet of steel built into the wall of a house or apartment

THE use of metal equipment in the home is increasing all the time. Kitchen cabinets, tables, chairs, washing machines, and ironers have been in use for some time. Cupboards, too, of metal have been introduced with success. Beds of iron and steel are common. Dressers and other furniture are also being made of steel.

The latest steel product for the home is a clothes vault. It comes in various sizes, ranging from the ordinary closet size for the small apartment to vaults big enough to hold large outfits of furs and other fabrics. Illustrated at the left is one type designed for the small apartment. It fits into a recess just as the regular closet does, and is supplied ready to set in place flush with the plastered walls. The door is stained to match the wooden trim of the rest of the room.

The cost of installation is said to be moderate. These new clothes vaults are claimed to be absolutely moth-proof, and also to protect their contents from dust and dampness. They are being installed in many newly constructed apartments, and are said to be popular features.

RODS OF CLEAR fused quartz are now being used to carry light to microscopes and so avoid heating the specimens by working too close to the light source.

Find Largest Human Skull

WHAT is believed to be the largest human skull in the world was discovered recently in South Africa. It belonged to a native who died a short time ago, and was found to measure eight and a half inches in length and have a capacity of 122 cubic inches.

The discovery of this huge skull in a present-day native is claimed by some anthropologists to strengthen the theory that Africa was the cradle of the entire human race.

Roller Brush Restores Surface of Cloth

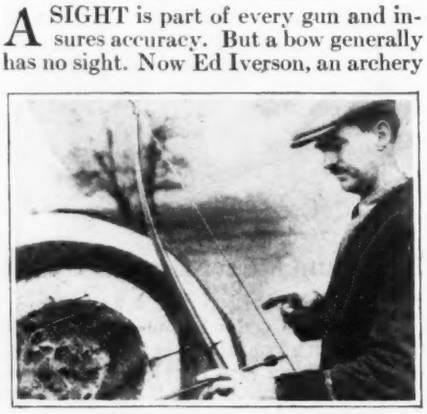
THE rollerlike brush, shown below, said to be very effective in restoring the surface of fur, imitation fur, velvet and other fabrics having a high pile, was recently invented by Elmer Hiatt, of Milford, Conn. The brush, which resembles somewhat the roller of a carpet sweeper, is mounted on a bar with two metal arms to which is attached a suitable handle. Its bristles are stiff, and are set in such fashion that in going over the fabric they raise the nap that has been flattened down by wear. It is said to take the curls and kinks out of fur and imitation fur and to give them the appearance of new goods.

A roller brush for furs

The roller brush will remove the shine from worn garments, it is claimed, by raising the nap. It can also be used for ordinary clothes brushing, removing dust and dirt more quickly and more thoroughly than the usual brush.

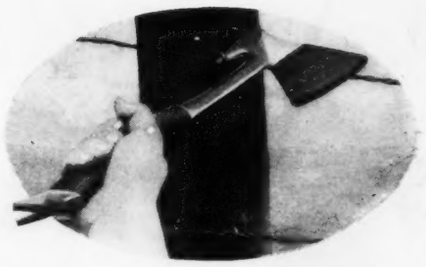
A Bow with a Sight

A SIGHT is part of every gun and insures accuracy. But a bow generally has no sight. Now Ed Iverson, an archery



expert, of Los Angeles, Calif., has made a few modern improvements on the ancient weapon to improve its aim.

He is shown above with a bow that he has equipped with a sight, and claims this addition helps him to shoot straight.



Combination Axe Made of One Piece of Steel

WITH head and handle of steel, forged and tempered in one piece, the handy new axe, illustrated above, is, by its very construction, unbreakable. The handle cannot work loose and come out, so there is no danger of the head's flying off. A hand-hold of leather gives a firm grip, and the hand does not come in touch with the cold steel. This steel axe is said to be lighter in weight than the usual wooden handled ones.

Two unusual features of this sturdy axe are a hook on the head that is useful for drawing out staples, as shown in the picture, and a claw at the end of the handle for pulling nails. Its head, of course, can be used for hammering. For camping and odd jobs around the house, this axe is particularly useful. It is a handy tool to carry on an automobile at any time.

Chromium Used in New Plating Process

AFTER long research, chromium, the hardest metal known, has been made by a new process available for plating. Chromium plating had been known for a long time to be possible, but until now it was not considered commercially practicable. The new process was discovered by H. E. Haring of the United States Bureau of Standards.

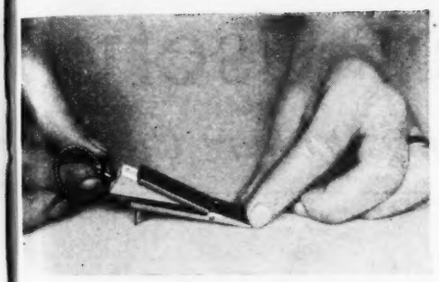
Chromium is now being employed in making electrolytic plates for the faces of our dollar bills. By applying a thin layer, only 1/5,000 of an inch thick, of chromium to these plates, their life is increased over twice that of case-hardened steel plates, and several times that of nickel-faced electrolytic plates without the application of chromium.

Broom on Wheels Speeds Sweeping

A DEVICE that, it is claimed, enables a child to operate a four-foot broom usually requiring a strong man's efforts, has been perfected by a San Francisco man. The broom is mounted on two rubber-tired wheels the height of the broom. Pushing down the handle throws the broom on the wheels and lifts it two or three inches off the floor. Lifting the handle sets the broom down on the floor ready to sweep.

The broom is moved easily from one spot to another without lifting it off the floor, and the sweeper can operate it a great deal faster and with much less effort than an ordinary broom. It is claimed that a person can do fifty percent more work in a given time with this new device than by the ordinary method.

Four-foot broom with rubber-tired wheels for easy, rapid and clean work on floors



Pocket Wedge Locks Door As Securely As Key

THE traveler who is inclined to be nervous and is not satisfied with the protection of the ordinary door lock in a hotel room may find the little wedge device illustrated above a very useful acquisition. It is small enough to be carried in the pocket, but is said to be efficient in keeping intruders out of any room.

The wedge slips under the door from the inside and holds the door so tightly it cannot be opened from the outside. Spikes keep the device from slipping. The central part of the wedge is attached to a cord, and can be pulled out quickly by the occupant of the room without his getting out of bed.

Submarine Motion Pictures to Reveal Sea Secrets

THE secrets of the ocean floor will soon be revealed by motion pictures, according to Dr. Paul Bartsch of the United States National Museum, Washington, who recently made an under-water camera hunt for fishes among the coral grottoes off the coast of Florida.

With a specially constructed waterproof machine, he secured hundreds of feet of pictures of submarine life, and spent as much as five and a half hours at a time walking about on the sea bottom at a depth of twenty feet below the surface. At this comparatively shallow depth, he says, life is varied and abundant, because corals and other small sea denizens remain in the midst of the breakers where the flow of the tide waters brings them constant fresh supplies of microscopic plants and animals for their food. The camera man in these regions has little to fear from larger fish, he declares.

Lawn Mower Has Sulky for Operator

SEVEN acres of lawn mowed in a day, and riding while doing it on an easy spring seat. That is the way this work is done these days. At the right is seen a new mower with a sulky attached, and, to provide even more comfort, the sulky is equipped with rubber pneumatic tires.

Built especially for lawn mowing work, the motor is strengthened to allow for the extra work of pulling the sulky and driver. This is said to insure longer life to the machine by relieving the strain. It travels on its own power, and the knives are sharpened by this power with special reverse gears. The sulky is detached when cutting steep embankments.

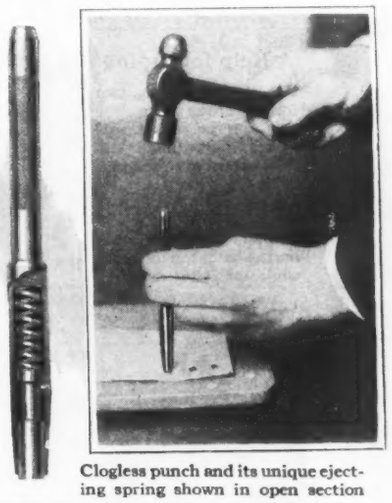
The mower has a safety clutch which slips when sticks or stones are met, to protect the knife.

Motor-driven lawn mower with sulky for use by the operator

A Self-Cleaning Punch

THIS new punch, below, it is claimed, never gets clogged. Fastened to a heavy spring inside the hollow punch is a plunger extending beyond the punch.

When the tool is lifted after a hole is driven, the spring ejects the cutting from the punch, and it is then clean for further use. The illustration below shows how this new punch is operated.



Clogless punch and its unique ejecting spring shown in open section

THE ENGLISH GOVERNMENT is making experiments to end the use of horses in war. A mechanical research camp was recently established near Aldershot to improve army tractors for light artillery and to develop heavy trucks for military and commercial transportation to replace horses.

A New Steel for Small Houses

A LIGHT structural steel which can be used for small houses in much the same manner in which heavier beams are employed in skyscrapers has been perfected recently by a Pittsburgh manufacturer. The new steel, while light in weight, has greater proportional strength than any other steel so far produced. Hitherto lightweight steel was impossible because there was no known way of rolling it, but after many years the necessary rolling process has now been perfected. The new steel can be used for floors and roofs as well as for beams.

Little Metal Mold Makes Neat Golf Tees

A QUICK and easy way to make a golf tee is provided by a little metal mold recently invented. Instead of trying to scrape up a tee with your hands, or looking around for a convenient substitute, or using an artificial tee that you have to chase as well as the ball, all you have to do, it is claimed, is scoop up some wet sand in the aluminum cup, illustrated at the right, pack it in tight by pressing against the side of the sand box, push on the top, and out comes the tee, as neat and firmly rounded as you could wish. It is not necessary to touch the sand with the hand.

Making a golf tee

The cup is of simple construction and does not get out of order. It is very light and can be carried in your pocket. It helps your game, too, it is said, by giving just the right kind of a tee for a good drive. It speeds up the game, too, fans say.

Motor Boats Displace Gondolas in Venice

Taxi boats on the Grand Canal, Venice, are displacing the gondolas. A couple of the famous old gondolas may be seen further up the canal

THE picturesque gondola of Venice is rapidly giving place to the more prosaic and speedier motor boat. It is doubtful whether the gondola will ever disappear entirely from the Venetian canals. For leisurely gliding along the Grand Canal and up the side canals, the gondola will always hold its own. But for rapid transit the motor taxi will displace it. In the picture at the left is seen the type of motor boats that are now popular in Venice.

Eighteen Useful

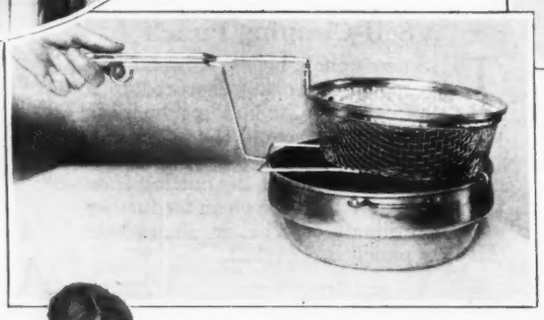
A Self-Basting Pressure Cooker;

A Self-Basting Cooker

No basting with a spoon is necessary—you do not need even to take off the lid, when you use the new vacuum low-pressure cooker, above, in which the food bastes itself. The steam rising from the lower compartment condenses on the lid and drips through holes in the upper tray on which the food is placed. The cooker is for use on a gas burner

Handle Will Not Char

A general complaint against the wooden handles on coffeepots is that the lower part chars from the heat of the metal and finally breaks away from its support. With the lower crosspiece made of metal, the coffeepot handle which is shown at the right cannot scorch or burn, and hence lasts longer. It can be put on a coffeepot easily and quickly



Drains or Fills Tubs

The hose with faucet attachments shown below aids in quickly filling and draining washing machines and tubs. Attached to both hot and cold faucets, it is used for filling. Used with one faucet, it rapidly and completely sucks up the water from the tub like a syphon

To Protect Your Shoes

Rubber spats that are easily slipped on over shoes or slippers are shown at the right. They are intended to protect your stockings and the toes of your shoes against spattering and dripping while you are working in the kitchen. They are made in many interesting designs and there are also very appropriate rubber aprons to match

A Help for Frying

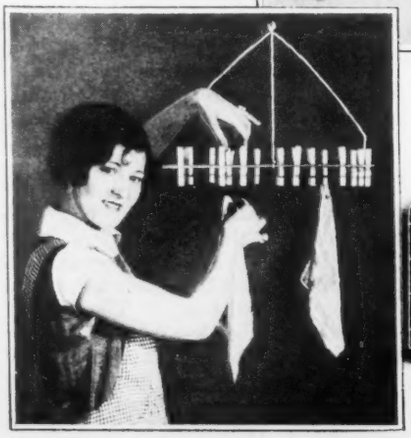
For deep fat frying, two folding hooks and a slide that can be pulled out, shown above, hold the wire basket over the pan while the excess fat is being drained off. This is an advantage over the ordinary method of holding the basket in the hand while the fat is draining

Deodorant for Ice Box

Contained in a wire receptacle is the specially prepared deodorant, above, which keeps the refrigerator sweet and odorless. To renew its strength, it is placed in a hot oven for a couple of hours, in order that the collected odors may be thrown off, after which it becomes active again

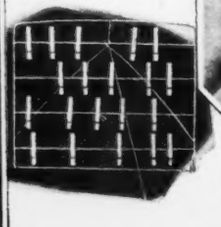
Prevents Breaking Loaf of Cake

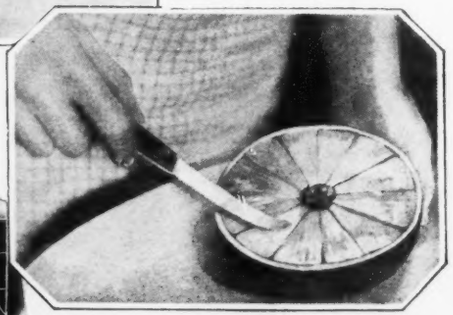
Breaking a loaf of cake in taking it out of the pan is to a cook a real calamity. The novel cake tin with a split rim, shown at the left, that locks with a metal clasp, averts this unpleasant possibility. The rim is unlocked by pressing a clasp, and then the base is easily removed, which leaves the cake in perfect condition



A Collapsible Dryer

An excellent kitchen fitting is the clothes dryer, at the right, that takes up very little space. The rack is made of rustproof wire and holds twenty clothespins. When not in use, it folds flat up against the wall as seen in the picture at the farther right





Curved Knife for Grapefruit

Preparing the breakfast grapefruit takes but a few minutes with a curved grapefruit knife, shown above. Both edges have saw teeth, that cut the fruit from the skin quickly and cleanly

Household Aids

Other Helps for the Homemaker

A Pliable Scraper

The scraper at the left is made of metal, and is so curved on all sides that it fits in all corners of the pan, no matter what its shape. The metal is thin and pliable and bends easily, so that it will not scratch aluminum. It can also be used for turning meats, eggs or vegetables while they are cooking

A Grater and Shredder

Very convenient is said to be the combination grater and shredder which comes with a stand that can be placed over a shallow bowl as seen below. It can be used for slicing potatoes for frying by the use of a special attachment, which is useful also for other vegetables

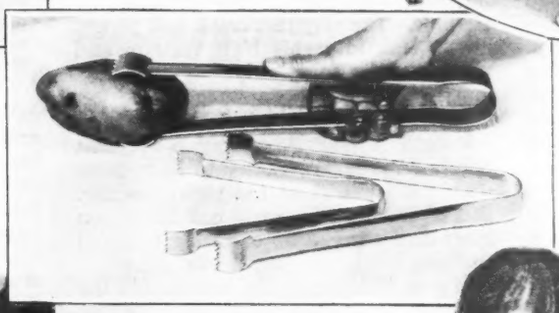
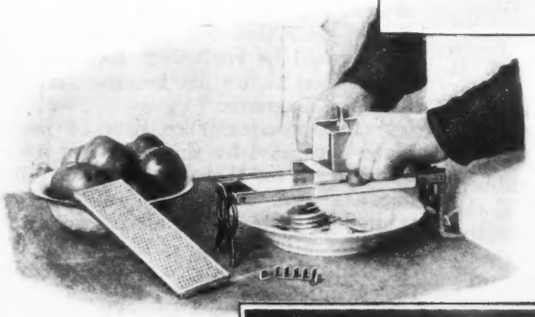


Table Hides Ironer

A small table that fits snugly into one corner of the kitchen no one would ever suspect to be merely covering the compact ironer shown above. When the ironer is not in use, all its mechanism is completely covered by a top that changes it into a very handy kitchen table. Illustration shows it at work



Tongs for Lifting

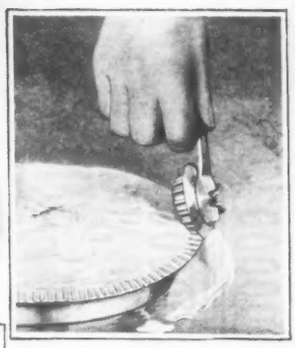
Kitchen tongs in three different lengths, above, make a handy kitchen set. The smallest is for bacon, toast or cracked ice; the medium size for corn, hot vegetables, small pieces of meats; the large size for baked potatoes or hot dishes

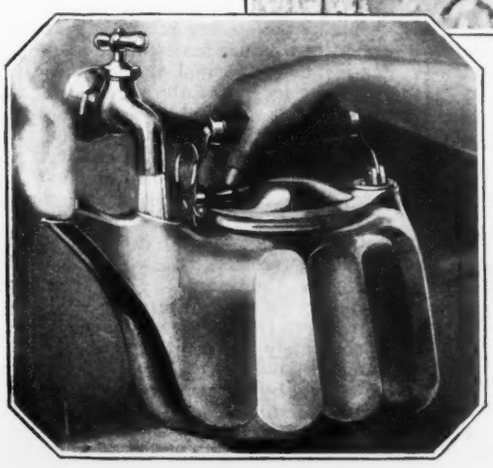
A New Potato Cutter

Cutting potatoes for French frying is ordinarily a lengthy, uninteresting task. But using the cutter shown in the picture at the left, with one stroke a whole potato is cut in neat and even strips for French frying. This cutter is made of metal, honeycombed in squares

Roller Bearing Rings for Shower Curtains

Curtains around showers have a disagreeable habit of sticking and refusing to budge when you try to move them. The roller bearing rings for shower curtains illustrated at the right are said to obviate this difficulty. A slight pull makes them glide along the pole smoothly and easily





New Type of Kettle Averts Scalding While Filling

To eliminate the danger of scalding while removing the lid or filling a teakettle containing boiling water, a novel kettle, shown at the left, with an opening in front of the usual lid and the handle, is being manufactured. This opening has a special cap to prevent the steam from escaping and causing injury

Pie Crust Crimper and Vent Cutter

Grandmother used to crimp the edges of her pies with a fork, and cut steam vents with a knife. You can do both more quickly with the little tool, above, that crimps the edge and cuts off surplus crust at the same time. It has projections for making air vents

An Adjustable Toaster for an Open Fire

Toast can be made at the fireplace without burning one's fingers by using the new jointed toasting fork on a pedestal, that may be seen at the left. It can be set in any position desired, and does not have to be held with the hands

Helps for Radio Beginners

You Can Lengthen the Life of Your Tubes

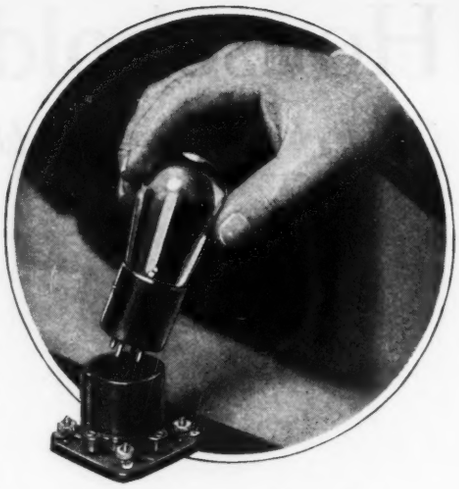
Where to Put the Batteries

GOOD vacuum tubes are absolutely necessary to get worth-while radio reception. You can change the circuit, use different coils or condensers, or entirely rebuild the set and still bring in the broadcast music or speech; but no matter how you shift things around, your results still depend entirely on the vacuum tubes.

Consequently, the beginner should firmly fix in his mind the idea that vacuum tubes must be treated carefully. The commonest way in which radio tubes are abused is to turn the rheostat too far in an endeavor to increase the volume when it is not loud enough owing to fading or poor receptive conditions that cannot be blamed on the receiver at all.

Of course, if you drop a vacuum tube and the glass breaks, there is no question as to its further usefulness—it is simply junk. But considerable damage can be done to vacuum tubes without actually breaking the glass, by rough handling when you put them into or take them out of sockets. The glass is cemented to the base and an extra vigorous twist may loosen the cement and tear the delicate connecting wires away from the prongs in the base.

Remember that the glass bulb of a vacuum tube contains some small metal pieces surrounded by the nearest thing to nothing at all that is now commercially possible. The slightest crack will permit air to leak into this high vacuum and ruin the tube completely.



Should Be Handled Like Eggs

Care should be taken in putting vacuum tubes into the socket and taking them out. An extra hard twist may loosen the cement and tear the delicate wires away from the prongs at the base

YOU can put your radio batteries, both A and B, at any convenient point. It is not necessary to have them within a few feet of the radio receiver. But no matter where you put them, you must do a careful job of wiring to avoid trouble.

If you wish to put the batteries in the cellar or in the closet of a near-by room, use heavy wire for the A-battery. It takes power to force electric current through wire in proportion to the distance it has to travel and the size of the wire. You can get good results by wiring up your storage battery with rubber-covered wire as small as No. 18 if the battery is not over three feet from the set; but, if you increase this distance to twenty or thirty feet, be sure to connect up your storage or dry cell A-battery with wire not smaller than No. 12.

Good insulation is worth while on the A-battery wiring because a short circuit may result in red-hot wires and a serious fire.

The size of the wires leading to your B-battery is not important no matter how far they are from your set, because the amount of current they carry is extremely small and the voltage is high. Well insulated wire is a good idea, however, because a short circuit will ruin five or six dollars' worth of dry cell B-batteries in a few minutes.

HERE are a few more of the symbols ordinarily used in radio wiring diagrams. Opposite each one is a picture of the part in the radio circuit it represents.

Basically, a so-called "tickler coil" is just like any other radio coil except that in most circuits it is mounted on a shaft so it can be rotated. In some wiring diagrams, this motion is indicated by a thin arrow through the tickler coil and the coil it affects, but generally the fact that the coil is mounted so it can be rotated is mentioned in the description accompanying the diagram.

An audio transformer used for amplifying the signals at audio frequencies in a receiver consists of two coils of wire wound on a closed iron core. While each manufacturer has his own ideas about the external shape, the theory of operation and the general arrangement of the parts inside is always the same. The symbol shown on this page for the audio transformer indicates the two coils, and the parallel lines between them indicate the core. The coils are actually wound around the iron core, and a true diagram should show this, but so many crossing lines would be confusing; consequently the method shown has become standard for radio diagrams.

A fixed condenser consists of metal plates separated by thin sheets of mica. The symbol for this part is two parallel lines as shown. A figure, such as ".0005," printed next to the symbol, gives the capacity rating of the condenser in microfarads that is needed at this point in the circuit.

The symbol for all kinds of batteries is a series of short and long parallel lines. Formerly the number of pairs of lines indicated the number of cells in the battery, but at present this rule is not followed. The same symbol is used to represent storage batteries and dry cells, so you must depend on the description accompanying the drawing for information as to the type and voltage of battery the symbol stands for.

THE SYMBOL	WHAT IT STANDS FOR
	TICKLER COIL
	AUDIO TRANSFORMER
	FIXED CONDENSER
	"A" BATTERY

A B C's of Radio

CAREFUL tuning has a lot to do with the quality of music that comes out of the loudspeaker. If, for instance, the dial that adjusts the wave length of the receiver is moved a trifle from the point where it should be to receive the station with maximum volume, the quality falls off slightly as the music becomes weaker. This is because some of the wave carrying the music is lost, and explains why it is not a good idea to regulate the volume by tuning out the signal.

For best quality, the set should be tuned to the proper wave length as accurately as possible, and the volume should be cut down, if it is too strong, by means of the volume control knob.

Your Radio in Hot Weather

How to Get Good Reception despite Summer Disturbances

By John Carr

TO YOU, as well as to millions of others, radio has become a steady source of good music and entertainment. You no longer consider your radio receiver a novelty—a fascinating and uncanny piece of electrical machinery to play with in odd moments and to be forgotten the minute summer reception troubles interfere with broadcasting.

And with the increased number of broadcasting stations operating on high power, there really is no reason why you should not get satisfactory results in spite of static and the other disagreeable effects that accompany hot summer weather.

Assuming that your receiver has been operating perfectly all through the winter, your first job is to make sure that the set itself is not intensifying the noises. Radio service men claim that at least ninety per cent of their trouble calls turn out to be either dead batteries or worn-out tubes. So test your batteries and make sure that they are in topnotch form.

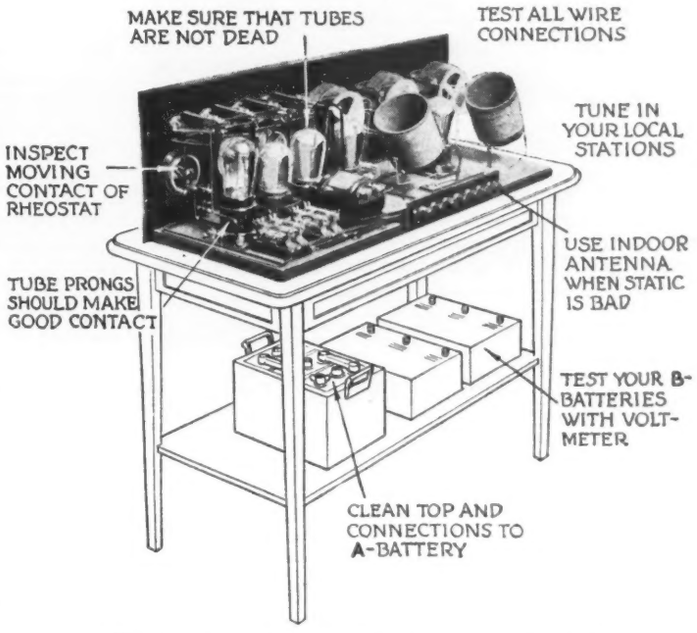
The A-battery that heats the filaments in your tubes should be checked up with a hydrometer and distilled water added if the solution is down to the tops of the insulators. If you have taken good care of your battery and recharged it at regular intervals, the chances are that it is in good condition.

There is a possibility, however, that the connecting wires have become corroded at the terminals of the battery. Corrosion at this point sometimes causes noises, but more often the effect is to make the current flow fluctuate in such a way that the filaments in the tubes become alternately brighter and dimmer and the volume from the loudspeaker changes just as it does when the signal actually fades in and out. Sometimes frying and crackling noises are produced when the top of the battery is covered with a moist slime made up of dust and battery solution, but usually the only result of this type of leakage is a loss of current that makes the battery run down more quickly than it should. It will pay to keep the battery clean on that account.

DRY cell B-batteries, when they are nearly run down, will often produce sizzling and crackling noises that sound just like real static. The remedy is new batteries, of course, but don't buy a whole new set of B-batteries until you are sure that the ones now connected to your set are to blame for the noise. Testing them with a volt meter will settle this point. If a 45-volt block reads 37½ volts or higher, you can be pretty sure that it is still in condition to give quiet service.

Storage B-batteries are in a class with storage A-batteries because they work in the same way. You must keep them properly charged and filled with water, and it is particularly important that you keep the wire connections free from corrosion, for, with many types of radio receivers, a very loud high-pitched howl will develop if a high and irregular resistance is introduced into the circuit at this point.

Weak socket springs that make poor contact with tube prongs, moving contact fingers on rheostats, loose binding posts, or other poor connections, are all possible sources of noises that may play hob with your reception.


MAKE SURE THAT TUBES ARE NOT DEAD
TEST ALL WIRE CONNECTIONS
TUNE IN YOUR LOCAL STATIONS
INSPECT MOVING CONTACT OF RHEOSTAT
USE INDOOR ANTENNA WHEN STATIC IS BAD
TUBE PRONGS SHOULD MAKE GOOD CONTACT
TEST YOUR B-BATTERIES WITH VOLT-METER
CLEAN TOP AND CONNECTIONS TO A-BATTERY

How to test your set to get the best results in summer

After you have made sure that your set itself is right, the next step is to check up on the antenna connections. Consistent, long-distance reception with quality sufficient to be enjoyable is almost an impossibility in summer no matter what kind of a radio set you have. For most of us it is fortunate, therefore, that the local stations put on such fine programs. If you have a multi-tube set and you are located within a few miles of one or more broadcasting stations, you will find it worth your while to investigate the use of a short indoor antenna. You really don't need the outdoor antenna for local reception, and you have probably found it necessary to turn down the volume control quite a bit when you are tuned-in to these stations. With an indoor antenna, you will find it necessary to turn up your volume control; but in most cases it will be found that the static noises are reduced enough to make it worth making a test.

A satisfactory indoor antenna can be made by stringing from ten to thirty feet of ordinary bell wire around the picture molding. The nearer you are to your favorite station, the shorter the indoor antenna can be for satisfactory reception.

THE fact that you put up an indoor antenna does not mean that you have to abandon the use of the outdoor antenna altogether. You can get a single-pole, double-throw switch and arrange the wiring so that you can shift to the long antenna when you want to amuse yourself on nights when the static is not bad by trying to bring in distant stations.

There is no adjustment you can make to your loudspeaker itself that will reduce the static without cutting down the music or speech in the same proportion. But there is one stunt that seems to work pretty well, and that is to move the loudspeaker into another room and then turn on more volume than you ordinarily use. Often the music will sound much better and clearer. This is probably due to the fact that the sustained vibrations of the music carry much better than the rasping and clicking noises of static.

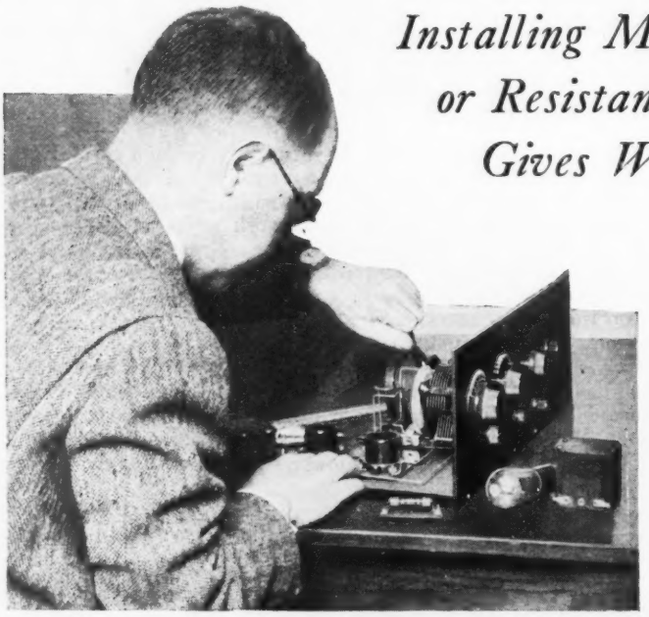
And placing your loudspeaker some distance from your radio receiver is a mighty good plan all the year round. If you keep the loudspeaker on top of or right beside the set, the strength of the music is such that it is difficult to tune properly. Moving the loudspeaker to the other side of the room has another advantage. It prevents the possibility of what is known as "audio feed back." This trouble is often the cause of particularly mystifying howls and squeals. The actual vibrations in the air produced by the loudspeaker may vibrate the detector tube in your receiver, and the tube turns them into electrical impulses which are amplified and again come out of the loudspeaker. The vicious circle is repeated again and again until a terrific howl is sometimes produced.

DON'T waste your money on devices sold for the purpose of eliminating static. The Popular Science Institute of Standards has tested many such devices, but so far not one has proved of any practical value. In every test it was found that, if the device reduced static at all, it also reduced the signal strength in the same proportion.

How to Improve Your Old Set

Installing Modern Transformers or Resistance-Coupled Units Gives Wonderful Tone

By ALFRED P. LANE



Study the Wiring Very Carefully

Improving your old radio receiver is not at all difficult, but you must be careful to make sure that you are on the right track before you start cutting and changing the amplifier wiring in the set

SOMEHOW that radio receiver you bought or built three or four years ago doesn't seem to sound as well as it used to. Probably you get the broadcast stations about as well as ever, but they sound tinny and the voices are either muffled or raspy.

The chances are that nothing has gone bad in your set. Electrically and mechanically it is still as good as it was the day you first put it in service.

What has happened is that your radio set is no longer up-to-date. Later models of home built and factory made sets far surpass it in the quality of reproduction. You have heard some of these modern sets in the dealer's store or in your friends' homes, and the natural music and understandable voices have made your set sound like a toy phonograph by comparison.

OF COURSE, the simplest remedy for this state of affairs is to buy one of the latest styles of radio sets after you are satisfied that it will give you the kind of reproduction you want. Another way is to build yourself a new set using modern parts in a circuit designed to produce the best possible quality. A third practical plan is to modernize your radio set and bring it up to present standards.

Assuming that for good and sufficient reasons you decide on the third course, your first job is to make a careful study of the internal arrangement of your radio receiver. Get out your ruler and carefully measure the space now occupied by the audio frequency amplifying transformers. Determine, also, the limit of space available, for when you try to install any of the modern types of audio transformers such as are illustrated in Fig. 5 you will find that they are in most cases much larger than the instruments now in your set.

And if you decide to use resistance-coupled audio amplification instead of transformer-coupled, you will need to find extra room in your set for a three-stage outfit such as is shown in Fig. 4.

As far as relative amplification is concerned, three stages of resistance-coupled amplification are about equal in volume to two stages when transformers are used. It will be for you to decide which type of amplification to use. Both give fine quality when they are properly installed.

At any rate, the problem of modernizing your radio receiver is chiefly a matter of removing the parts in your set that perform this function and substituting modern instruments and wiring arrangements. Distortion and poor quality reproduction are sometimes produced in the radio frequency amplification and detector stages in radio receivers, but most of the trouble is in the audio end.

Possibly you are unfamiliar with the various parts in your radio set. Fig. 5 will help you to determine which are the audio transformers, as the instruments in your set will be of the same general type. Each one has four wires running to it, and your task is to remove these two instruments, bolt the modern ones in place, and connect the wires to the terminals of the new transformers. Disconnecting and removing the old transformers is a simple proposition. Bolting the new transformers in place is also easy. But you may have some trouble with the wiring if the receiver is factory built and the terminals of the old transformers are not marked. Fig. 3 will help you on this point. Note that there are always four terminals on an audio transformer. Two of them are marked "P" and "B," with "Primary" or "PRI" marked on the frame of the instrument between them. The other two are marked "G" and "F," with "Secondary" or "SEC" in line with them on the frame.

ALL modern transformers are marked and, if the old instruments in your set are also marked, it is simply a matter of connecting the new in place of the old. If not, you will have to identify them by the wiring. The "B" terminals are always connected to the binding posts on the back of the set which are marked "B AMP" and "B DET." The "F" terminals of the transformers are connected either to the filament wiring or to the

We Will Help You!

SEND for the list of radio apparatus approved by the Popular Science Institute of Standards. It will help you to choose trustworthy parts to modernize your old radio set.

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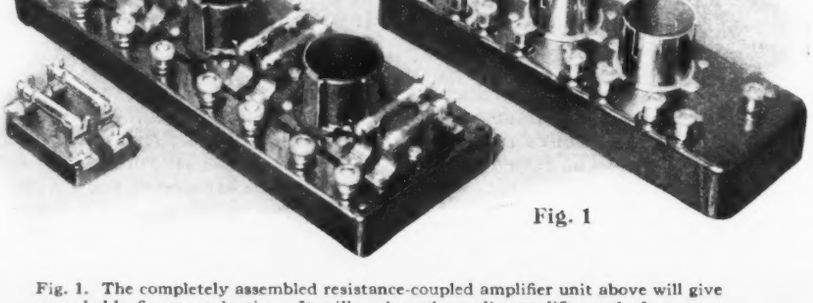


Fig. 1

Fig. 1. The completely assembled resistance-coupled amplifier unit above will give remarkably fine reproduction. It will replace the audio amplifier end of your set

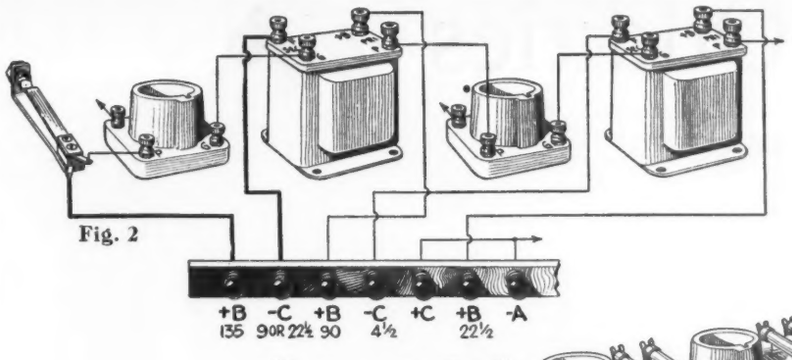
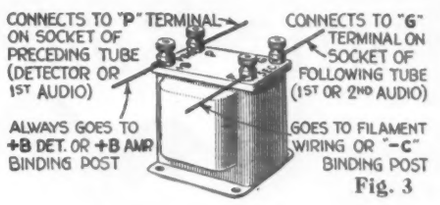


Fig. 2

As It Should Be

Fig. 2. After you have modernized the audio amplifier in your set, the wiring should be as shown above. Note the two heavy lines indicating the wires to the extra binding posts. Up-to-date transformers and a power tube in the last stage will give you excellent quality and volume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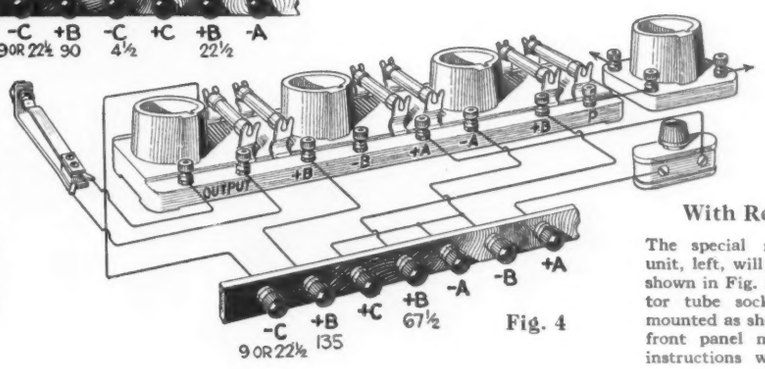

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With Resistance Coupling

The special resistance-coupled amplifier unit, left, will take the place of apparatus shown in Fig. 2. At right end is the detector tube socket. The rheostat can be mounted as shown or it can be used on the front panel marked "amplifier." Follow instructions which are packed with unit

binding post marked "Minus C." The "G" terminal of the last audio transformer is always connected directly to one of the terminals of the socket that holds the last tube, and the "G" terminal goes to the similar terminal on the next to the last tube. A study of Fig. 2 will help you. Be sure you are right before you disconnect any wires at all.

The mere substitution of modern transformers for out-of-date ones in an old set will effect a great improvement in the quality, even if no other changes are made; but the improvement will be still more marked if you also arrange your set for the use of one of the new types of power tubes. And this extra advantage can be gained with little additional work, as you will have to disconnect all of the wires involved when you install the transformers.

THE proper use of a power tube requires just two changes in your present wiring regardless of how it is now connected up. One is to fit a new binding post at the back of the set as shown in the diagram of Fig. 2, and connect the loudspeaker jack or one binding post to it. Then you fit another extra binding post and connect the "F" terminal of the same transformer to it.

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There is one other arrangement that will appeal to a number of radio fans, particularly those who are located in the larger cities where many stations are received with so much volume that the set is rarely operated on full power. In a case of this kind, it is possible to substitute one stage of resistance-coupled amplification for the second transformer-coupled stage in your set. The result will be a great improvement in the quality, although the volume will be somewhat less.

If you are interested in changing your set in this way, look over Fig. 1 again and you will note a small instrument at the left end resembling a tubular grid leak mounting built to hold two grid leaks instead of one. And that is just what it actually is, except that a coupling condenser is concealed in the base. This resistance coupler mounting can be substituted in your set for the last transformer. The procedure is the same as for another transformer. The four terminals are marked as are transformer terminals and should be connected in the same way. Because of its small size, there will be no difficulty in fitting it into the allowed space.

TO USE a power tube in the resistance-coupled stage is also a good idea if you want best quality, and the directions given for the use of a power tube with a transformer apply in the same way. In other words, the "B" terminal of the resistance coupler unit should be connected to the extra, high-voltage binding post, and the "F" terminal of the coupler to the extra C-battery binding post. In this case the high voltage is applied to the plates of all the amplifier tubes.

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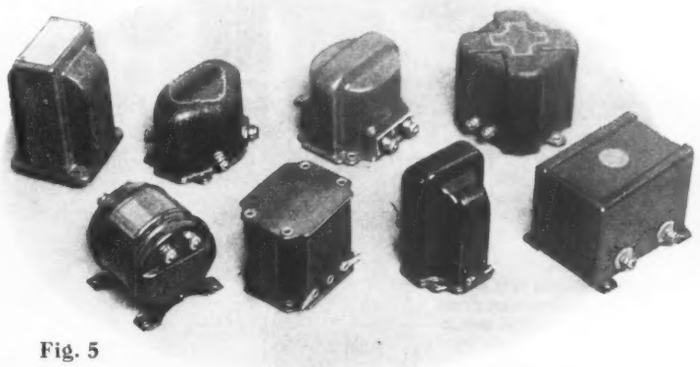


Fig. 5

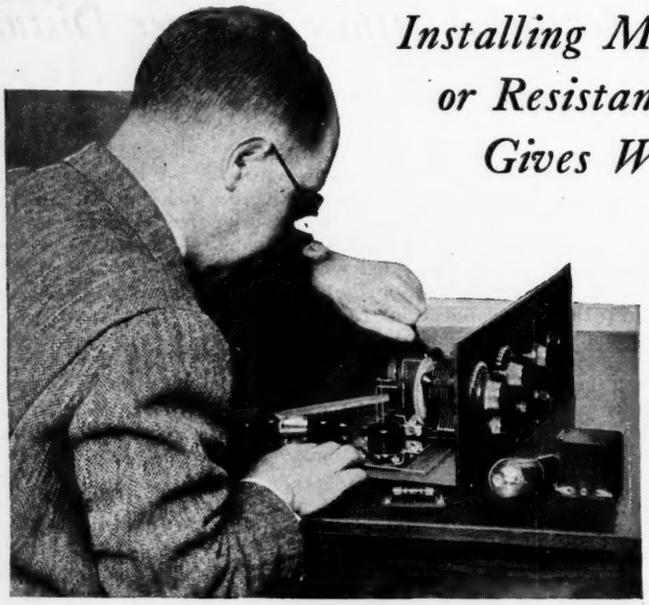
Modern Transformers Give Fine Quality

Startling improvements have been made in last two years in audio transformers, types of which are shown above. They reproduce high and low notes far better

How to Improve Your Old Set

Installing Modern Transformers or Resistance-Coupled Units Gives Wonderful Tone

By ALFRED P. LANE



Study the Wiring Very Carefully

Improving your old radio receiver is not at all difficult, but you must be careful to make sure that you are on the right track before you start cutting and changing the amplifier wiring in the set

SOMEHOW that radio receiver you bought or built three or four years ago doesn't seem to sound as well as it used to. Probably you get the broadcast stations about as well as ever, but they sound tinny and the voices are either muffled or raspy.

The chances are that nothing has gone bad in your set. Electrically and mechanically it is still as good as it was the day you first put it in service.

What has happened is that your radio set is no longer up-to-date. Later models of home built and factory made sets far surpass it in the quality of reproduction. You have heard some of these modern sets in the dealer's store or in your friends' homes, and the natural music and understandable voices have made your set sound like a toy phonograph by comparison.

OF COURSE, the simplest remedy for this state of affairs is to buy one of the latest styles of radio sets after you are satisfied that it will give you the kind of reproduction you want. Another way is to build yourself a new set using modern parts in a circuit designed to produce the best possible quality. A third practical plan is to modernize your radio set and bring it up to present standards.

Assuming that for good and sufficient reasons you decide on the third course, your first job is to make a careful study of the internal arrangement of your radio receiver. Get out your ruler and carefully measure the space now occupied by the audio frequency amplifying transformers. Determine, also, the limit of space available, for when you try to install any of the modern types of audio transformers such as are illustrated in Fig. 5 you will find that they are in most cases much larger than the instruments now in your set.

And if you decide to use resistance-coupled audio amplification instead of transformer-coupled, you will need to find extra room in your set for a three-stage outfit such as is shown in Fig. 4.

As far as relative amplification is concerned, three stages of resistance-coupled amplification are about equal in volume to two stages when transformers are used. It will be for you to decide which type of amplification to use. Both give fine quality when they are properly installed.

At any rate, the problem of modernizing your radio receiver is chiefly a matter of removing the parts in your set that perform this function and substituting modern instruments and wiring arrangements. Distortion and poor quality reproduction are sometimes produced in the radio frequency amplification and detector stages in radio receivers, but most of the trouble is in the audio end.

Possibly you are unfamiliar with the various parts in your radio set. Fig. 5 will help you to determine which are the audio transformers, as the instruments in your set will be of the same general type. Each one has four wires running to it, and your task is to remove these two instruments, bolt the modern ones in place, and connect the wires to the terminals of the new transformers. Disconnecting and removing the old transformers is a simple proposition. Bolting the new transformers in place is also easy. But you may have some trouble with the wiring if the receiver is factory built and the terminals of the old transformers are not marked. Fig. 3 will help you on this point. Note that there are always four terminals on an audio transformer. Two of them are marked "P" and "B," with "Primary" or "PRI" marked on the frame of the instrument between them. The other two are marked "G" and "F," with "Secondary" or "SEC" in line with them on the frame.

ALL modern transformers are marked and, if the old instruments in your set are also marked, it is simply a matter of connecting the new in place of the old. If not, you will have to identify them by the wiring. The "B" terminals are always connected to the binding posts on the back of the set which are marked "B AMP" and "B DET." The "F" terminals of the transformers are connected either to the filament wiring or to the

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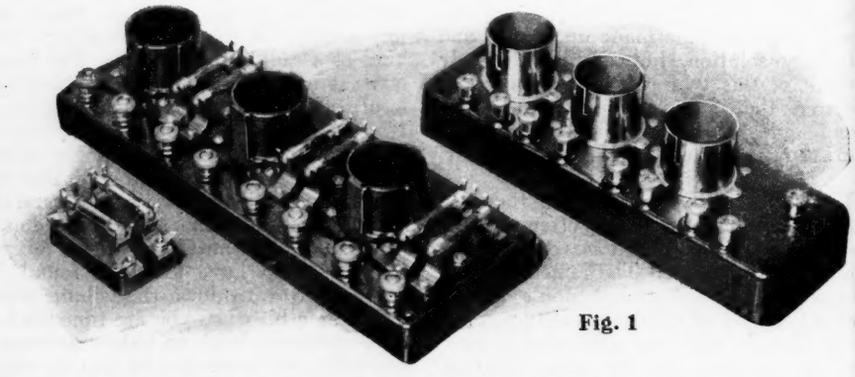

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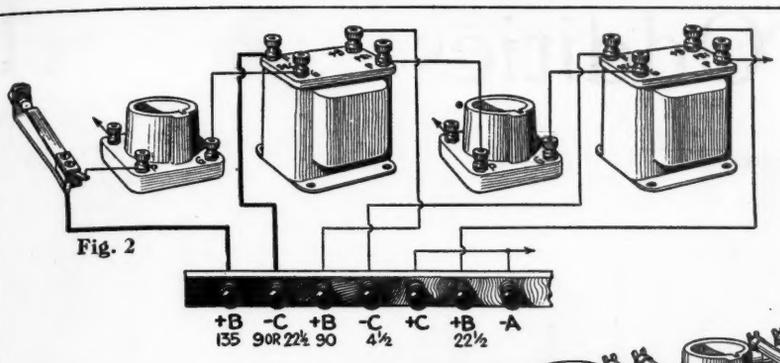

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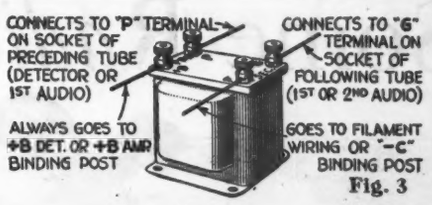
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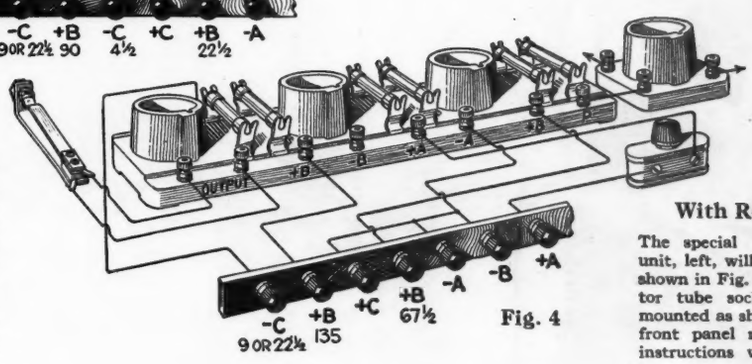

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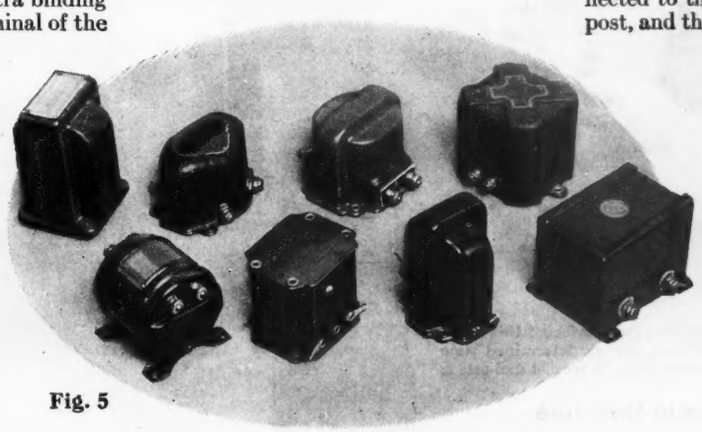

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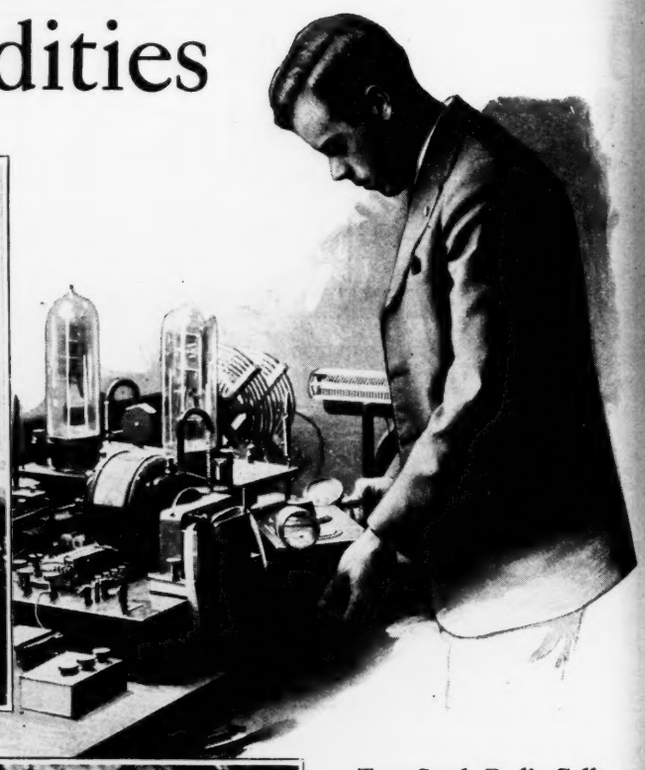


Mammoth Radio Set Built for Explorer

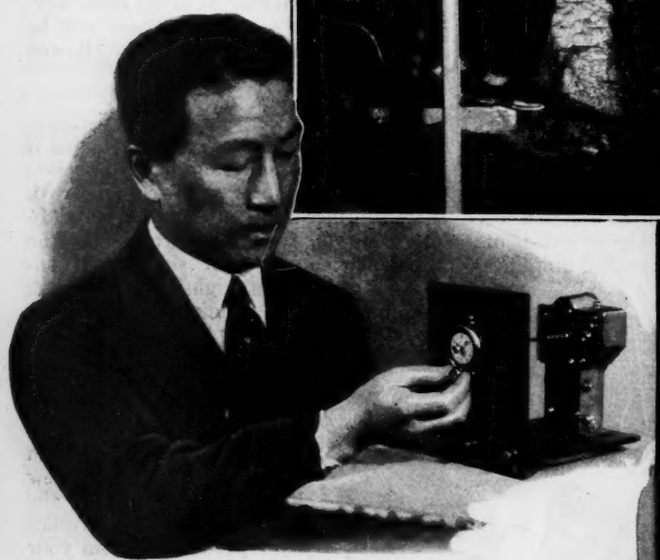
The fourteen-tube radio set, above, is now being used by G. D. Bricker, mining engineer, on his exploration tour in South America. It was constructed by Robert L. Gaston and Fred Jewell, who are shown giving the huge outfit a final inspection. It is of the superheterodyne type and includes a tremendously powerful five-stage amplifier of the impedance type

Tape Sends Radio Calls

At station 2ZV, Richmond Hill, Long Island, the short-wave transmitter above has been arranged with a special mechanism that sends radio calls automatically by means of a tape. At scheduled times in recent weeks this apparatus was used to send calls to Arctic expeditions. It is expected that these steady signals will be of great assistance in the handling of all radio messages

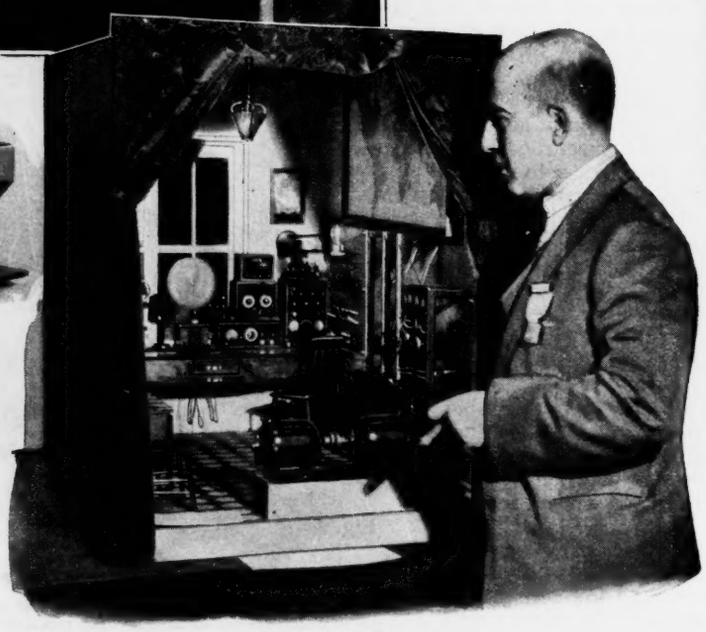
2,000 Feet Underground

At the left George W. Miller and John Pfost testing the quality of radio reception in the Cave of the Winds, Manitou, Colorado, 2,000 feet below ground. The six-tube neutrodyne receiver was set up in the "Bridal Chamber" among stalactites estimated by geologists to be more than 5,000 years old. The experimenters report it was easy to bring in stations at distances up to 1,000 miles, with very little static



Clock Starts and Stops Receiver

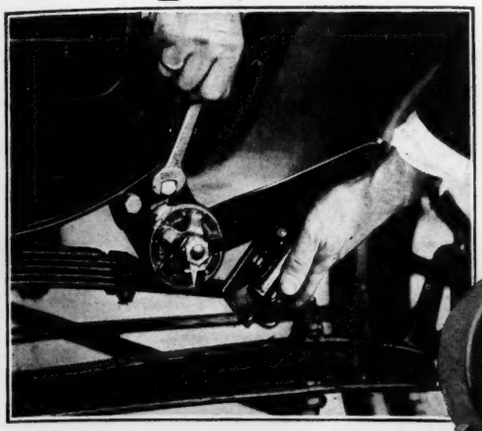
A Japanese inventor, Ushichiro Tokumi, has just perfected this novel clock, above, that switches on the radio at any predetermined time and also turns it off in the same convenient way. A special dial sets it



Complete Station in Miniature

At a recent show, Frank Frimerman exhibited this astonishingly complete model of his radio station 2FZ, right. Every detail is so perfect that a photo duplicates a view of the real station

Helpful Fittings for Your Car



Shock Absorbers Easily Put On

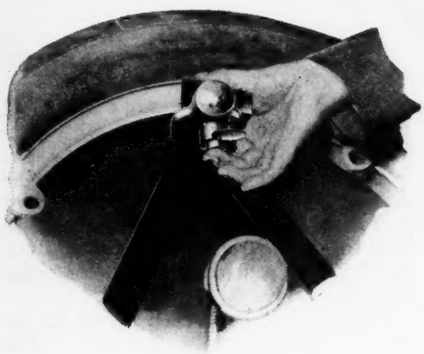
This powerful shock absorber will appeal to the owner who likes to do his fitting himself, as a complete set of them can be fitted in about twenty minutes with the aid of ordinary wrenches. No drilling or machine work is needed for installing them

A Unique New Wheel Puller

Designed for use on all cars built with hub caps threaded sixteen threads to the inch, which includes nearly all cars except the Ford and Chevrolet, the device shown below recuts crossed or battered threads as well as pulling wheels. The large bolt in the center is used to apply pressure to the end of the shaft while the other bolt adjusts the three threaded jaws to the correct diameter of axle

Light Aids Hand Signaling

This newest motoring help is ordinarily in a bracket on the dash where it serves as a dash light, but it can be instantly shifted to the hand and serves to illuminate it so that the driver behind will be sure to observe the signal at once

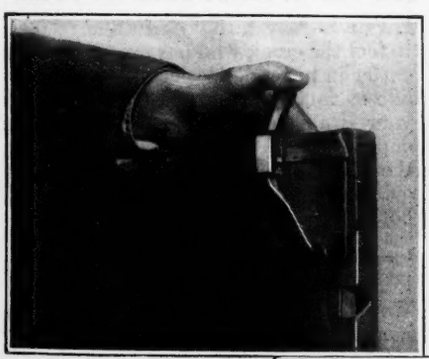


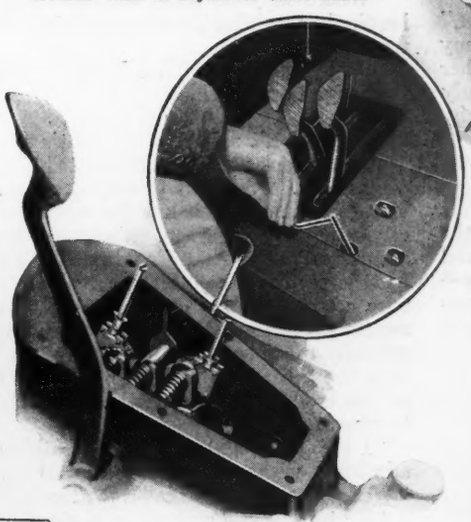
Crank Adjusts Bands

The remarkable outfit, below, is fitted to the transmission of the Ford car, and, by way of holes bored through the floor board, a small hand crank can be used to turn the projecting rods. It requires but a few seconds' time to adjust all three bands

Thief-Proof Lock for Spare Tire

This new lock, above, takes the place of the ordinary chain and padlock used to protect the spare tire from theft. It fits on instead of the nut, and the two heavy prongs prevent turning



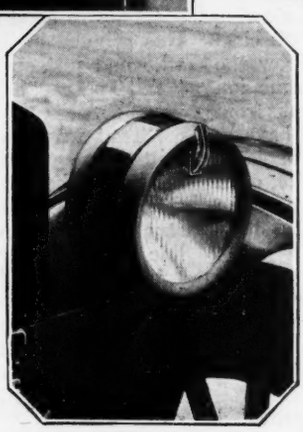


Extension for Horn Button

On cars where the horn button is attached to the side of the steering column underneath the wheel, the simple accessory illustrated above enables the driver to blow the horn without taking his hand off the steering wheel

Extension Handle for Door

While the present trend in automobile design is to place door handles on the inside on open cars to improve the lines of the car, it is sometimes hard to catch the lever without considerable fumbling. The new extension door handle, above, made of polished nickel aluminum, eliminates this trouble. Itslips on over the end of the regular handle as shown

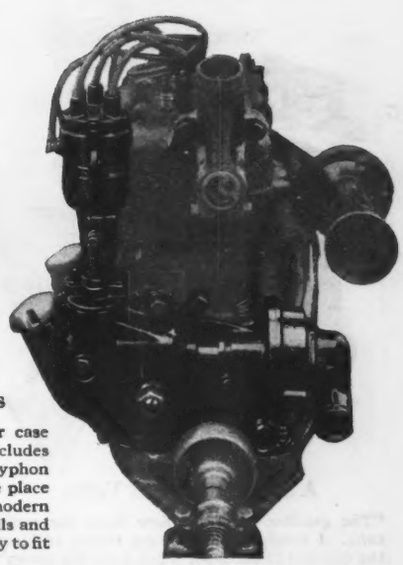


Tells If Lights Are On

This simple device, left, is attached to the front lens at the top. Light, traveling through the bent glass tube, shines to the rear as a glowing spot. If the glowing spot disappears, you know at once that the headlight bulb has burned out and needs immediate replacement

Accessory Does Three Things

Replacing the regular Ford timing gear case cover, the ingenious device at the right includes a water pump to supplant the thermosyphon cooling, a positive gear pump to take the place of the splash-gravity oil feed, and a modern ignition system to replace the buzzing coils and roller timer. No machine work is necessary to fit



How to Foil the Auto Thief

Gus Points Out a Half Dozen of the Best Ways to Lock Up Your Car

By MARTIN BUNN

"WHERE is your lock?" Gus inquired. "Right there," said Thatcher, pointing to the ignition switch. "Why, that's no protection," snorted Gus. "You can get a switch key for most any car in the nearest garage"

"GOT your car back again, I see," said Gus Wilson as George Thatcher drove up to the Model Garage.

"Yeah, what's left of it," replied Thatcher in a glum voice. "Those crooks sure did shoot this bus all to pieces in the two weeks they had it. Nothing works right. And just look at the scratches and dents in the body!"

"Maybe it isn't so bad," said the veteran mechanic hopefully, as he raised the hood and inspected the power plant. "How come you didn't lock it the day it was stolen?"

"How did you know it wasn't locked?" demanded Thatcher.

"Humph!" growled Gus. "Nearly all stolen cars weren't locked. What's the good of locks if you don't use 'em? Pretty soon the insurance companies are going to make extra low rates on what they call coincidental locks; the kind that throw on automatically when you turn off the ignition to stop the motor."

"Don't worry! I won't forget again," said Thatcher positively. "I've had my lesson. After this I'm going to lock her up every time I get out,—even if it's only to step into a store for a pack of cigarettes."

"That's the right idea," Gus encouraged as he got out his tool kit and began adjusting the carburetor. "After a while it will become second nature to turn the key in the lock when you get out, and it's a cinch no crook will take your car—unless you leave it out all night or something like that. No lock is any good if the crooks have plenty of time to work on it. If they can't pick the lock or break it, they just come along with a tow car acting like it was a regular trouble call, hoist up the front end and take your car to some place where they can have all the time in the world to break up the lock.

"Where is your lock, anyway?" he inquired, examining the steering wheel and transmission.

"Right there," said Thatcher, pointing to the ignition switch.

"YOU don't mean to say that's the only lock you've got!" snorted Gus disgustedly. "Why, that's no protection. You can get a switch key for most any car in the nearest garage. We keep quite a stock of them. And it's no trick at all for the crook to connect up a piece of wire around the switch. Ignition locks are no protection at all unless they are specially made so that all the wires and even the timer itself are enclosed in steel so the crook can't get at the terminals to wire around it."

"I never thought of that," Thatcher admitted with a sheepish expression. "Well, what would you call a good lock?"

"Best thing I know of is a steering wheel lock that disconnects the wheel so that it turns free when you throw the lock on," replied Gus. "A transmission lock is good, but it won't stop crooks from towing your car away. All they have to do is to park their car in front of yours and, when no one is looking, hook on a tow rope and drive off, with one of the gang sitting in your car to do the steering."

"You'd better fit one like that after you get done with the rest of the repairs," said Thatcher. "Or can't you fix up some kind of a secret lock on the ignition or the gasoline line that the crook won't know about?"

"Sure I can," Gus replied, "provided I put it where you can work it without making any queer motions with your hands when you stop and get out. That's because crooks often hang around where cars are being parked, and if they spot you lifting up the hood or anything like that they are sure to get on to what you are doing. Then what good is the secret lock?"

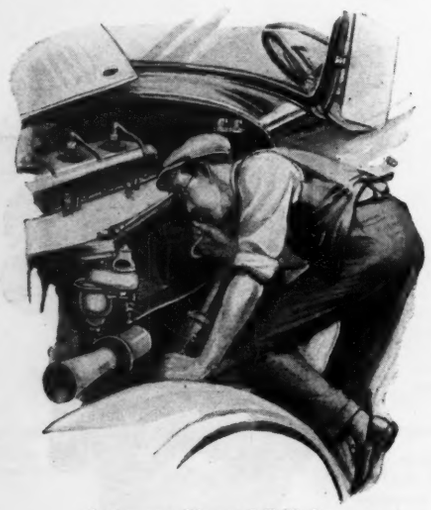
"They must have been laying for me all right," observed Thatcher. "The week before the car was stolen, they got away with a brand new spare tire, and I had it locked on, too."

"With one of those dog chains and a twenty-five-cent padlock, I suppose," said Gus sarcastically. "You've got to have a mighty husky chain and padlock to fool the crook who has a powerful bolt cutter in his car. He just cuts the chain like so much cheese and walks off with your tire as easy as can be. The best dope I know is not to keep a new tire on the spare tire rack. Always have your oldest tire on the rack. Nobody would bother to swipe an old shoe."

"THAT'S a good tip," said Thatcher. "What about those secret locks? Wouldn't it be a good idea to have one in addition to the lock wheel?"

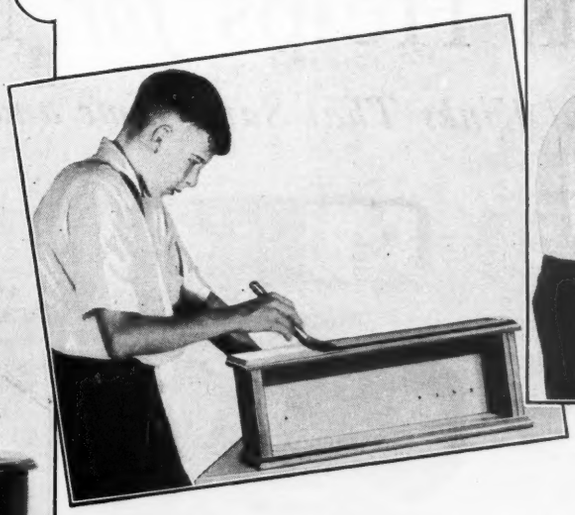
"They're good all right—sometimes." Gus grinned at Joe Clark, his partner, who had just strolled out of the office. "Tell Thatcher about the one that fooled you, Joe."

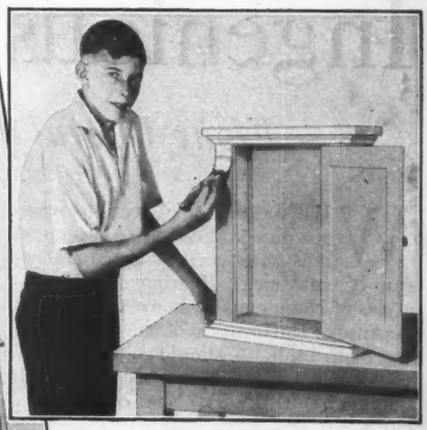
"That was one on me all right," admitted Joe. "Gus was away and I went out with the tow car on a telephone trouble call from a man who said he was stuck. And he sure was stuck. The gasoline wouldn't flow from the main tank. I nearly busted a lung trying to blow the dirt out of the pipe. Then I got out the tire pump, but that didn't work either, so I hitched on the tow rope and pulled the car all the way here to the garage. The owner went down the street to do some errands. *(Continued on page 126)*



A Secret Shut-Off Valve

"The gasoline wouldn't flow from the main tank. I nearly busted a lung trying to blow the dirt out of the pipe. Then I got the pump"





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Ingenious Helps *for* Motorists

Eight Useful Kinks That Save Time and Annoyance

WHEN traveling in sections where gasoline stations are miles apart, it is wise to carry an emergency can of gasoline. Pouring from many styles of these cans is, however, not easy because of the location of the filler cap on the main tank. A simple solution of the problem is to use a section cut from an old inner tube, Fig. 1. Near one end of it cut a slit just large enough so that the nozzle can be forced into the opening. Tuck the other end of the inner tube into the filler opening, and the gasoline can be transferred from the emergency tank to the main tank without spilling it all over the rear end of the car.

Fig. 1. New way to transfer gasoline from emergency to main tank

IT IS becoming almost standard practice on low and medium priced automobiles to place the storage battery underneath the floor boards where it is hard to get at, and, as a consequence, thousands of motorists allow their batteries to go for long periods of time without adding water or cleaning the terminals. Such treatment is not good for the battery. To eliminate this difficulty, cut a square opening in the floor boards directly over the battery, nail two cleats underneath as shown in Fig. 2, and cut out a piece of board the right size to fit in the opening. Bore a finger hole so that you can lift out the board.

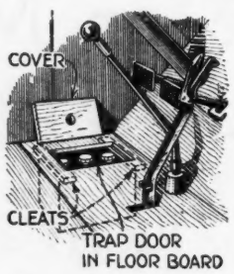

Fig. 2. This trap door makes it easy to inspect a battery or add water

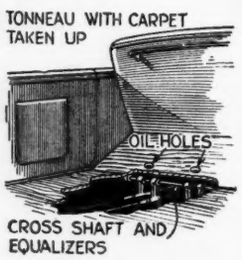

Fig. 3. Here is an excellent way to oil all the brake mechanism

JUST because a moving part of an automobile is out of sight does not mean that it can work for long periods of time without lubrication, even if it does not move continuously while the car is in motion. The rods and lever used to operate the brakes are in this class, and, because they cannot be lubricated without crawling under the car, they are frequently never oiled at all. Considerable wear takes place and after that they rattle most annoyingly. Instead of crawling under the car, lubricate them through holes bored in the floor boards as shown in Fig. 3. By locating the holes, oil dropped through the center of each hole will strike the right point if the car is level.

Fig. 4. This coat hanger will hold your coat even if loop is broken

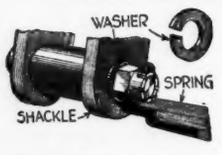

Fig. 5. Spring washers eliminate noise by taking up play in shackle

IN HOT summer weather, especially when driving with the wind, many drivers desire to take off their coats. Ordinarily, the coat is thrown over the back seat, where the jouncing soon throws it down on the floor. And if the car is crowded, some one is sure to sit on the coat and get it full of wrinkles. The simplest remedy is to buy an ordinary coat hanger and screw it into one of the bows of the top, as shown in Fig. 4. By bending the top hook down close to the lower one, the hanger will hold a coat even if it is not fitted with a loop. Set the opening so that the collar of the coat can be forced between the hooks.

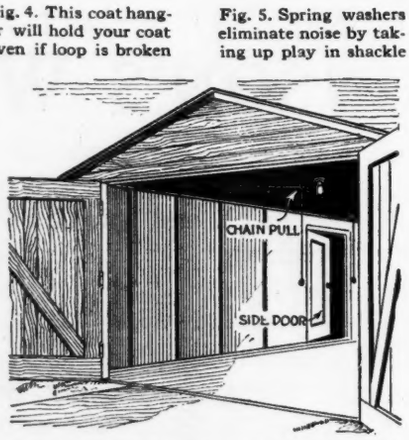

Fig. 6. A helpful arrangement for garage light

Fig. 7. Name scratched on back of license plate may bring it back to you

AFTER an automobile spring shackle bolt has been in use for some time, wear takes place and allows some play between the parts. The result is rattling noises every time the car strikes a bump in the road. It is possible to eliminate the trouble by the proper use of heavy spring washers. The sharp corners should be ground off and a washer fitted under the bolt head, as shown in Fig. 5, on each shackle that has worn loose. Be sure that the hole in the washer is large enough to slip over the shoulder on the bolt, and be careful not to set the nut up too tight. Cotter pins are absolutely necessary in this arrangement, so be sure to drill a new hole for the cotter pin if the nut covers the old one.

STUMBLING over a can of oil or barking your shins on some of the garden tools can be eliminated by fitting the ceiling light in your garage with a chain pull type of socket and then running one pull to each point at which you enter or leave the garage either on foot or in the car. As shown in Fig. 6, a good arrangement is to put a screw eye in the ceiling a short distance from the light and then run three cords through the opening and tie them to the end of the chain. Supported by another screw eye, one cord can be dropped by the back entrance door and the other two to each side of the main doors, where they can be reached easily from the car.

LICENSE plates on automobiles often work loose and drop off the bracket. You will find it worth while to scratch your name and address on the back of your new license plates with a sharp instrument so that if you lose a plate, the finder will be in a position to return it.

THE common method of deflating a tube is to screw out the valve, but this method often results in rolling the packing ring out of place or in destroying it completely so that the valve cannot be used again. To construct the special cap shown in Fig. 8, remove the inner rubber washer, drive a nail through the top just far enough so that it will open the valve and file a notch in the top to allow the air to escape. Be sure to file off the point of the nail so it will not slip off the valve stem.

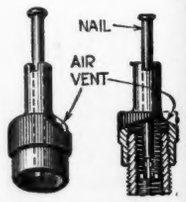

Fig. 8. Altered cap saves time in deflating tube, prevents injury to valve seat or washer

Ten Dollars for an Idea!

ERIC B. ROBERTS, of Regina, Saskatchewan, wins the $10 prize this month for the brake shaft oiling idea in Fig. 3. Each month POPULAR SCIENCE MONTHLY awards $10 besides space rates for the best idea for motorists. Other published contributions will be paid for at usual rates.

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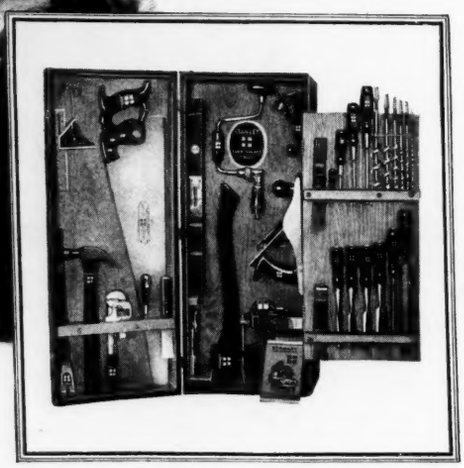

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The Home Workshop

Arthur Wakeling, *Editor*

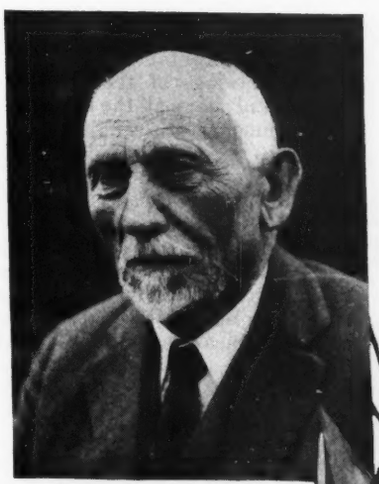
ARCHERY—The Latest Summer Sport

Old Art Has a Great Revival—How to Make Your Own Bow and Arrows—The New Target Games

MEN and women all over the country are turning this summer to archery as an outdoor sport. That is partly due to the exploits of Arthur Young, Dr. Saxton Pope and Stewart Edward White, previously described in POPULAR SCIENCE MONTHLY. *But the main reasons are the fascination of shooting with bow and arrow, and the fact that young and old can take part in contests and in the new game, archery golf.*

By DAN BEARD

National Scout Commissioner
Boy Scouts of America



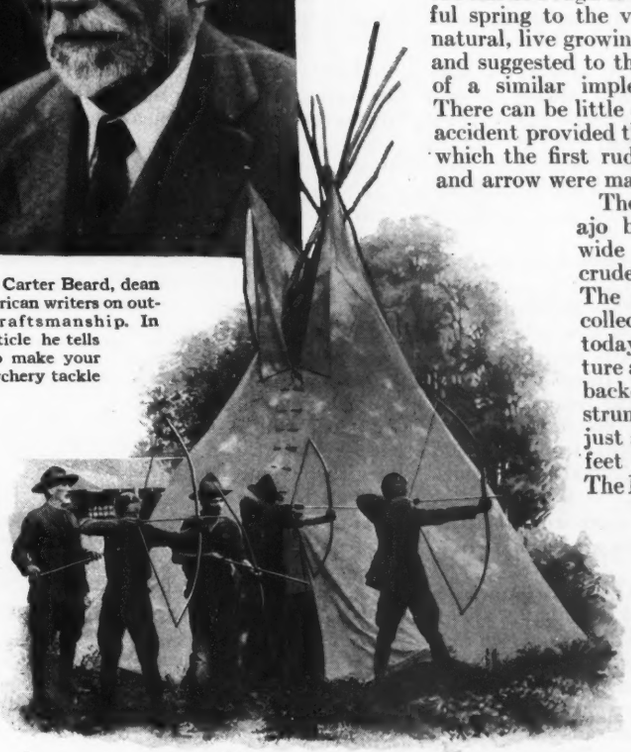
Daniel Carter Beard, dean of American writers on outdoor craftsmanship. In this article he tells how to make your own archery tackle

THE boys on the Ohio river made their bows from the staves of sugar hogsheads; from hickory hoop poles; from steel ramrods of Civil War muskets; from barrel hoops or barrel staves; in fact, from anything they could lay their hands upon, that was springy.

They made their arrows also of any material, preferably white pine, because white pine was plentiful and the packing cases, called in those days "dry goods" boxes, were made of the best pine, straight grained and clear of knots. This wood had a wonderful smooth cutting quality when whittled with one's jackknife.

We never saw a bow that was made for the market, such as you find now in all the outfitting and sporting goods stores. In the ancient and much thumbed "Boys' Own Book," there were pictures of some such bows, but we did not believe they really existed outside of picture books.

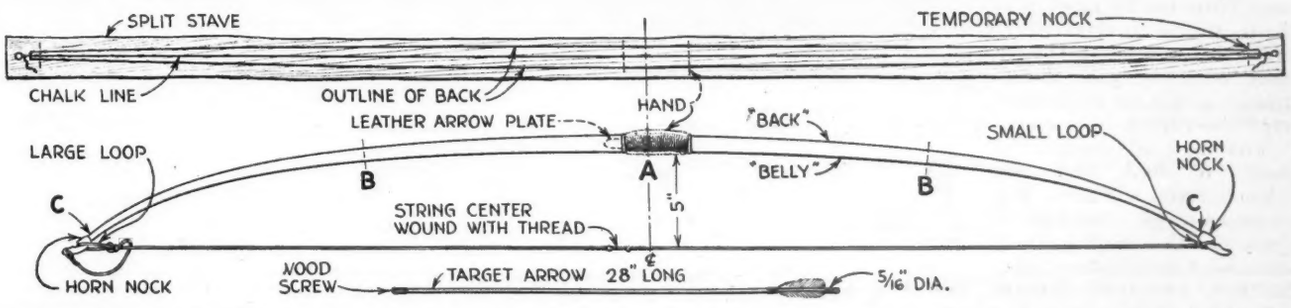
Of course, it is only guesswork on the part of anyone who attempts to tell us just how the bow and arrow originated. But not long ago an old Navajo Indian told an acquaintance of mine that the use of the bow was discovered by an Indian climbing up a tree and placing his feet upon a tough vine, which extended from the trunk of the tree to the end of a bough. Jumping up and down on this vine, he was delighted to discover that the elastic bough of the tree gave a powerful spring to the vine string. It was a natural, live growing bow and bowstring, and suggested to this Indian the making of a similar implement as a weapon. There can be little doubt that some such accident provided the real germ idea from which the first rudely constructed bow and arrow were made.



The present-day Navajo bows, however, are a wide departure from the crude branch implement. The bows to be found in collections and museums today of Navajo manufacture are well made, skilfully backed with sinew and strung with a sinew cord; just such a bow hangs a few feet behind me as I write. The Eskimos also used sinew in making their bows.

Every one of my readers knows that Robin Hood and his merry men were armed with long yew bows and quarterstaffs. It is, indeed, the long bow of England—the Robin Hood bow—that now

(*Continued on page 84*)



To make a bow, a piece of hickory or other springy wood is split out to insure straight grain. Then the stave is tapered as shown. A handgrip, horn tips, and bowstring complete the bow. Arrows for men's bows are usually 28 in. long. For smaller bows, they are half the bow's length

A Yacht Model for Racing

You Can Be Both Builder and Skipper of This Easily Constructed Yet Speedy Sailboat

By Capt. E. Armitage McCann

Fig. 1. Full-size drawings of the hull of this exceptionally fast 20-in. yacht model can be had by sending 25c to the Blueprint Service Department, Popular Science Monthly, 250 Fourth avenue, New York City, for Home Workshop Blueprint No. 48

SAILING a yacht model on pool, river, lake or sea is among the best of sports. Only those men—those very old men, indeed—in whom the bright fires of boyish enthusiasm have turned to ashes, may not agree with me; I know that all young and grown-up boys will.

Yachts may be purchased all ready to put in the water, but that is poor sport compared with trying out and sailing one built with one's own hands. As a compromise, semiready parts may be bought and assembled. For those who adopt that plan, the following remarks will be found useful because, though the type of yacht may be different from the one described, building methods are somewhat similar.

The best fun is to start with the raw material and make the whole boat from truck to keel.

It's a proud moment when we launch on the water the yacht we have spent pleasant hours in building, and see her skim along, straight as a dart—wind aft or leading—to the appointed mark. It is interesting to learn her moods and to trim the sails and adjust the rudder. To add to the excitement, we may enter her for races, perhaps to be overtaken by those that were builded better than ours, or, more fortunately, to win for us the coveted blue ribbon.

The material required is easily obtained, and the "handyman" will have the necessary tools—a hand saw, a tenon or other small toothed saw, chisel, gouge, plane, light hammer, two small clamps, a fine bradawl or twist drills, and a brace and ¼-in. bit.

First of all, draw plans of every part to the full size of the desired boat. You can save yourself this work by sending 25 cents for Home Workshop Blueprint No. 48 to the Blueprint Service Department, Popular Science Monthly, 250 Fourth avenue, New York City. The blueprint contains full-size drawings of the hull, and shows all the parts much more clearly than it is possible to do in the restricted limits of a magazine page.

The measurements given are for a 20-in. yacht (21 in. over all and 19½ in. load water line), but larger or smaller models may be made by increasing or decreasing all measurements proportionately. The plans are suitable for a boat of from about 10 to 30 in.

If you plan to join a model yacht racing club, consult the secretary and build your yacht so that it will meet the specifications of the club in regard to dimensions and sail area and, therefore, be eligible for racing against models of other members.

If you do not make use of the prepared blueprint, it is best to draw the plans on tough tracing paper, which can be laid on the wood, the lines then being scribed through by means of a sheet of typewriting carbon paper.

The hull consists of the main block (which may be in two or three pieces), the side planks, and the deck.

The main block A, Fig. 3, below, is a piece of straight-grained soft white pine, 2¾ by 7 by 20 in. If two pieces are used, the upper one should be 7 by 20 in.; it should be 1½ in. thick at the fore end and 1 in. at the after end. Plane the bottom true, and on the sides mark the sheer line, A^1. Cut away to this line. On the top lay your full-size plan drawing, centering it accurately, and scribe the outline, A^2. Cut away to it.

THEN cut away the inside, leaving the sides about ⅜ in. thick at the top and bottom edges; the wood can be thinner between, except at the bow, where enough should be left on which to fasten the upper stem.

The lower block, if two pieces are being used, should be ⅞ by 6 by 18¼ in. Plane the top and see that it fits the bottom of the top block. Mark the outline and cut away the waste. Glue the two firmly together and help the glue with a few brads driven down through the lower edge of the top block, being careful to point them so that the ends will not appear when the hull is cut to the final shape. Put these pieces between boards and clamp together or place under a heavy weight for twenty-four hours.

Regarding the glue to be used, the best is casein glue, often called airplane or cold water glue, (*Continued on page 92*)

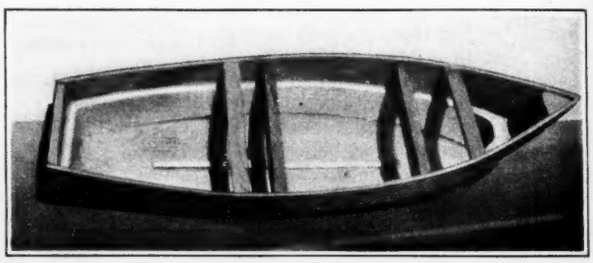


Fig. 2. The hull with both temporary molds and permanent deck beams in place. The molds are removed before the deck is fastened

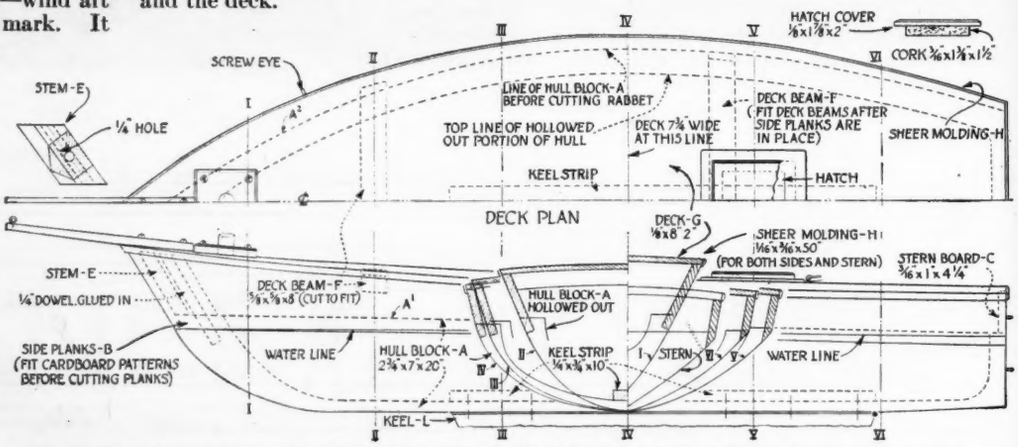
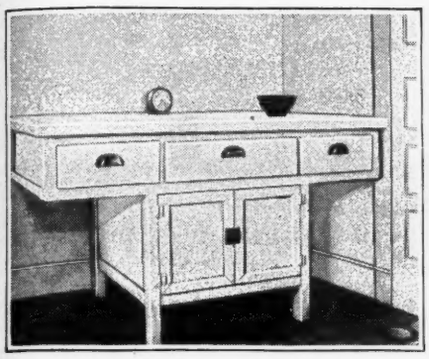


Fig. 3. One half the plan view, the side elevation, and a series of section lines. Note that the section lines show the shape of the hull at station points marked I–VI, and at the stern. These points are exactly 3 in. apart

The Home Workshop

How to Make a Zinc-Topped Kitchen Worktable

By RUFUS E. DEERING

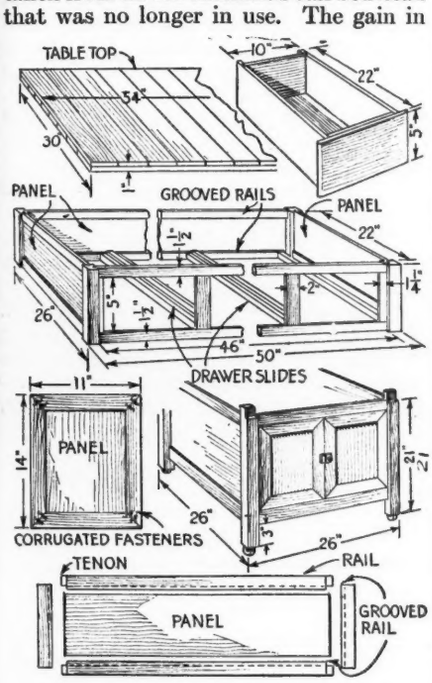


This table resembles closely in design an approved type of domestic science worktable

I HAVE just made a zinc-topped kitchen table that is giving excellent service in our home. The advantages of a zinc-topped table over wood are that the top does not stain readily, is easy to clean, always looks well, and never needs refinishing.

If the zinc does become stained, it can be cleaned in a few minutes by applying a weak acid such as vinegar or lemon juice, and then washing with clear water.

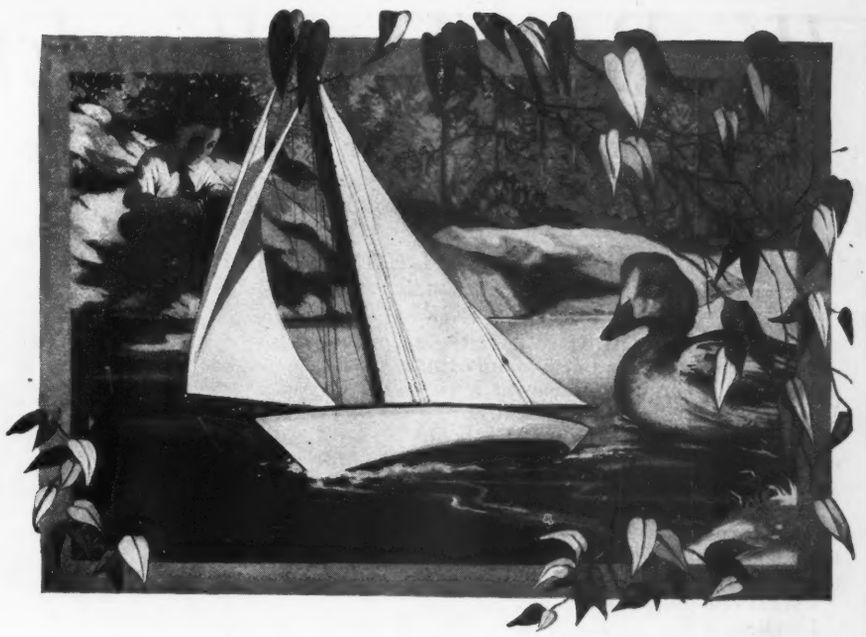
In making this table, I used lumber taken from an old-fashioned oak bedstead that was no longer in use. The gain in



The table top, framework of top and bottom sections, paneling, and drawer and door construction are shown in the above details

doing this was that I did not have to cut grooves for any of the rails or the frames for the doors. This is always a help to the home woodworker who has few tools.

I designed the table to resemble somewhat the type often used in the domestic science departments of colleges. The whole top part with the three drawers may be lifted off (*Continued on page 79*)



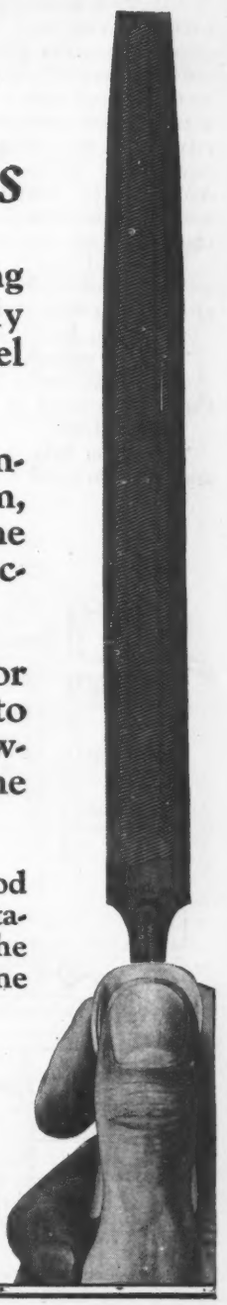
Easier to build with Good Tools

IN summer, a very young man's fancy seriously turns to thoughts of model boats.

Whether he builds one himself or you do it for him, good tools will make the work easier and more effective.

NICHOLSON Files, for example, shape the mast to fit exactly, taper the bowsprit and smooth down the ends of the planks.

Your hardware dealer sells good tools. And knowing their reputation and how useful they are, he naturally includes a complete line of NICHOLSON Files.



NICHOLSON FILE CO.
Providence, R. I., U.S.A.

NICHOLSON U.S.A. (TRADE MARK)

~a File for Every Purpose

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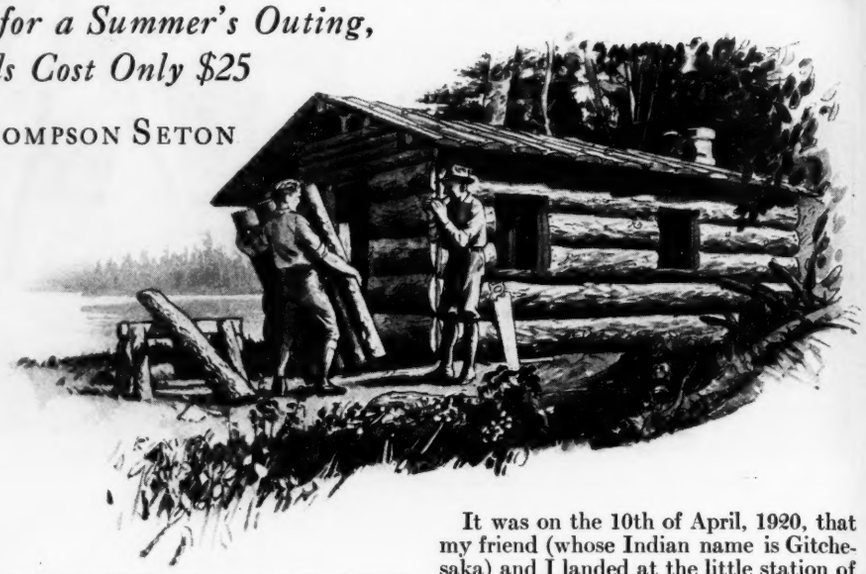
We Build a *Woodcraft* Cabin

It's a Comfortable Shelter for a Summer's Outing, Yet the Materials Cost Only $25

By Ernest Thompson Seton



A FRIEND of mine, who had charge of certain Y. M. C. A. activities, was planning for a new camp. He submitted his outline to me, as he knew I had long specialized in such things.

The first item was "ten tents to hold eight men each—$160 apiece."

"How is that?" he asked.

"No good at all," I replied. "Those tents will cost $250 each before you get them floored and furnished, and will last only five years."

"What else can we do?"

I replied:

"Make a woodcraft cabin. A lot of athletic young men should be ashamed of going camping with nothing but store stuff. It would be a priceless experience to them—and that is what they go for—if each group made its own cabin. Properly made, the cabins would cost about twenty-five dollars each for material. Your huskies would supply the labor, and the cabins would last fifty years. I could build one myself in a week."

My friend was a man of vision. He seemed profoundly impressed. Then, after a moment's thought, he said:

"Will you do it if I face the cost?"

"Yes," I replied.

"One man could build it in a week. Could two build it in half a week?"

"Yes, indeed."

"Will you take me for your second, and let us go build it together?"

World Famous Naturalist Lends a Helping Hand

IF YOU were going into the woods for a camping trip and could choose a companion from among the most distinguished living authorities on woodcraft, one of the first names to occur to you would be that of Ernest Thompson Seton, Chief of the Woodcraft League of America. In this article, indeed, Mr. Seton extends a helping hand to you and tells you exactly how to construct a camp shelter.

"Glad to!"

—and that was how it came about. For the result of our little talk that day was the Woodcraft Cabin in the Blue Ridge mountains, back of Asheville, N. C.—a cabin that has since been copied in nearly every part of the United States. It is a cabin that should be used as a model of cheapness and effectiveness wherever new camps are being founded.

It was on the 10th of April, 1920, that my friend (whose Indian name is Gitchesaka) and I landed at the little station of Black Mountain, N. C., and hired a trap to take us to the camp ground, three miles up in the woods.

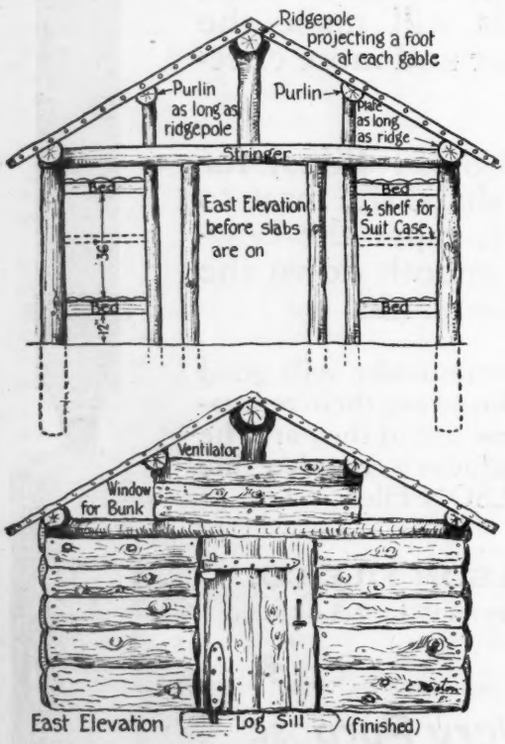
First, we obtained tools: two good axes, a hatchet and a hammer, a two-handed saw and a handsaw, a 2-in. auger, a brace with some bits, a spade, a pickax, a crowbar, a level, a square, and a plumb line.

For material, I bought 10 lbs. of 5-in. nails, 10 lbs. of 4-in., 5 lbs. of 3-in.; 3 rolls of slate-covered roofing paper, and 2 cords of 8-ft. slabs (about 100 in number). These came from the mill, and were delivered by mill team. The total spent was less than $25.

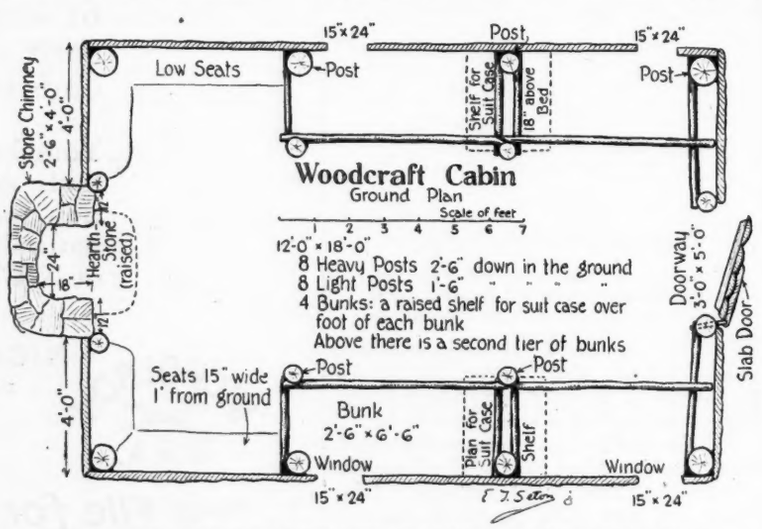
Near a sweet little spring, I laid out the shanty, 12 by 18 ft. Then we went into the woods and cut a lot of chestnut poles. There were plenty of these, all the chestnut being dead.

We dug post holes at each corner; then other holes to divide each side and each end into three parts, as in the plan.

The posts were cut off even at 6 ft. from the ground. Stringers 12 ft. long were laid across the ends; then, across the sides, a 20-ft. stringer, which gave a projection of 1 ft. at (*Continued on page 90*)



How the end of the cabin was framed and then finished with common sawmill slabs, bark side out



The plan of the original woodcraft cabin. It contains eight bunks in two tiers, as well as built-in seats and a picturesque stone fireplace. The sketches are by Mr. Seton

The Home Workshop

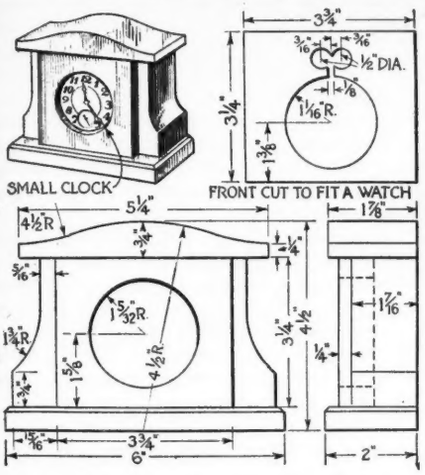
Scraps of Wood Form Neat Clock Case

By H. J. MacDonald

New York Military Academy

THIS easily made but beautiful little clock case can be constructed from scrap pieces of wood. A wood that insures an attractive-looking case is aromatic red cedar, but mahogany, walnut or any hard wood will serve very well.

The diameter of the hole may be changed to fit the clock that is to be inserted. The case also can be designed to hold a popular priced watch; the only change is in the boring of the center piece. Care must be taken in boring the hole or holes to see that the wood is held tightly



By making the hole or holes in the front block the correct size, either a small clock or a cheap watch can be used as the timepiece

in the vise. Use a sharp expansion bit for the large hole and only bore through one side until the point of the bit shows; then turn the block over and bore from the other side.

The top and end pieces are cut out with a chisel and then sanded down to size. It is best to make first a cardboard templet as a guide.

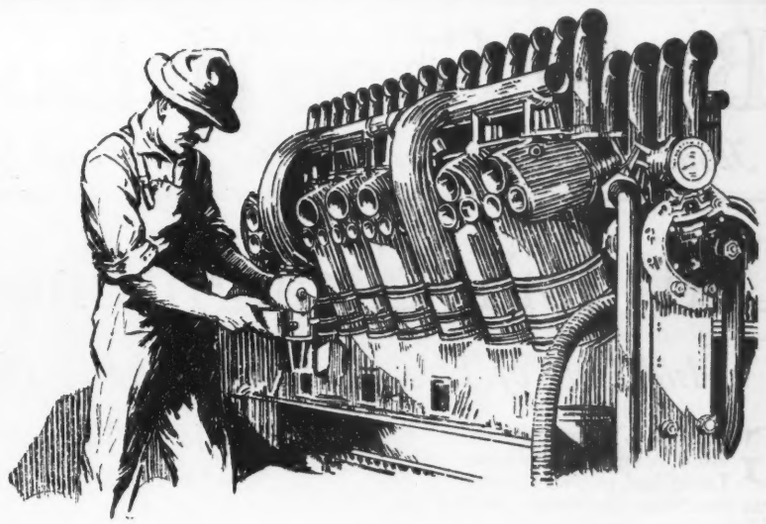
In finishing the clock, it may either be stained to match the surroundings and varnished and rubbed, or, if made from a prettily grained piece, it may merely be sanded and waxed.

The stock necessary consists of 1 piece ½ by 2 by 6 in., bottom; 1 piece ¾ by 1⅞ by 5¼ in., top; 2 pieces $\frac{15}{16}$ by $1\frac{7}{16}$ by 3¼ in., sides; and 1 piece ¾ by 3¼ by 3¾ in. for the center.

Crack Filler for Furniture

ON SEVERAL occasions I have filled small cracks and holes in furniture satisfactorily with a mixture of five parts varnish and one part whiting. As this filler was used only for wood in a natural finish (not painted), it was necessary to add sufficient dry tinting colors to match the wood to which it was to be applied—burnt sienna for mahogany, and orange chrome for oak.—W. J. Edmonds, Jr.

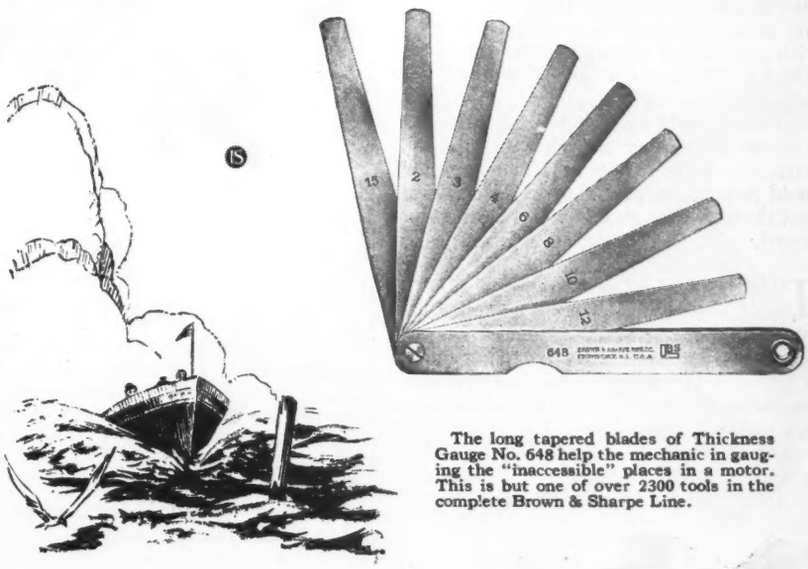
Turn to page 76 for the continuation of the Home Workshop Department.



Here's where .001" might mean a mile at the finish line

ONE thousandth of an inch, plus or minus, may lose the race. Building a powerful motorboat racing engine and keeping it tuned to its best performance is the matter of constantly working to thousandths of an inch in fitting and adjusting its multiple parts. The Quality and Utility of Brown & Sharpe Tools recommend them for such work of the highest standard. They aid in determining the exactness of the engine parts and in setting the delicate adjustments. Every place where the all important demand for exactness is encountered—there you will find Brown & Sharpe Tools.

Send for the new No. 30 Small Tool Catalog. Write for your copy today.



The long tapered blades of Thickness Gauge No. 648 help the mechanic in gauging the "inaccessible" places in a motor. This is but one of over 2300 tools in the complete Brown & Sharpe Line.

BROWN & SHARPE TOOLS

Brown & Sharpe Mfg. Co. *Dept. P.S.* Providence. R. I., U. S. A.

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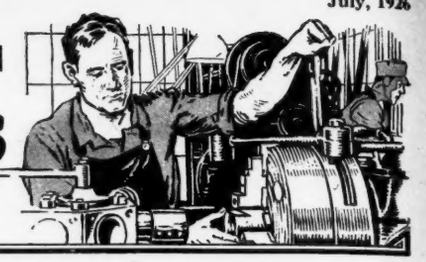
Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Straightens a Big Shaft

And One of His Customers Shows Him a Keyseating Kink

By JAMES ELLIS

Machine Shop Superintendent

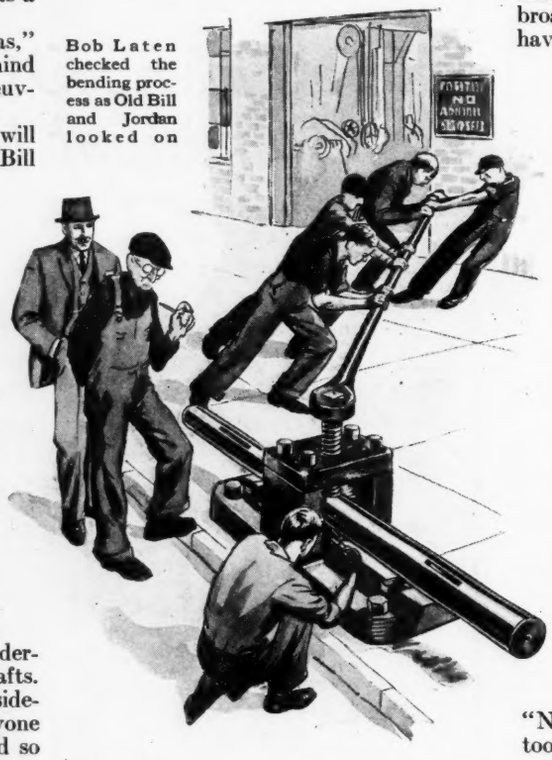
GRADUALLY the lathe came to a stop. A series of chalk marks Bob Laten had put on the shaft while it was revolving now stood revealed as a peculiar spiral along its length.

"It's a whole lot better than it was," remarked Ralph Jordan, who stood behind Laten's shoulder watching his maneuvers.

"About three more tries and he will have it straight again for you," Old Bill said. He also was one of the watchers.

While they were talking, Laten made two longitudinal streaks on the 6-in. shaft where he thought he ought to bend it in order to get it entirely straight again. Then he measured the amount the shaft was out of true at these two places, so that he would have something to guide him after he had taken the shaft to the shop's straightening press.

If Laten had been a golfer instead of a machinist, he would have referred to Jordan and Old Bill as his gallery, so intently did they follow him about. He got the shaft out of the lathe and onto a truck; then, with the aid of several helpers, he rolled it out to the sidewalk, where, firmly fixed to the concrete, was a ponderous device used to straighten large shafts. No one knew why it was on the sidewalk; it had been there as long as anyone could remember, and since it worked so well there, a change had never been suggested.



Bob Laten checked the bending process as Old Bill and Jordan looked on

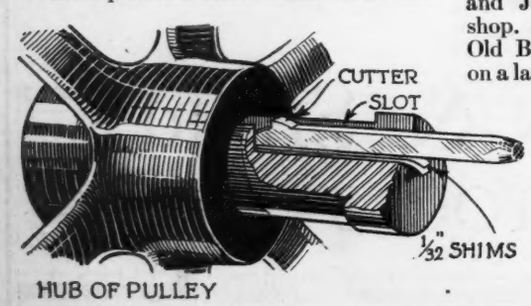
THERE was a cast-iron bed about 6 ft. long, with a cross member at the center for a screw about 4 in. in diameter. The reason for its being fixed so securely to a foundation, and perhaps the cause for its being on the sidewalk, was evident when the helpers lifted a wrench about 12 ft. long to set it on the squared end of the screw.

Laten placed a block under either end of the shaft as it rested in the press. He turned it so that one of his streaks of chalk was up, then calipered from the shaft to the bed just below the screw. This was so that he could tell how much he had bent the shaft when he put on the pressure. There was quite a bit of grunting and straining, and many anathemas were laid on the crooked shaft, the machine, and the world in general before Laten was satisfied.

The bending well under way, Old Bill and Jordan walked back through the shop. Jordan's eye happened to fall upon Old Bill's keyseating machine, at work on a large pulley.

"You folks in a regular shop have machines to do many things that we have to do by hand out at the plant," Jordan remarked. "We have to keyseat pulleys from time to time, so I had one of the boys make up a set of 'drifts' once when there did not seem to be much to do. Then we made some mandrels with slots in them, tapered one-eighth inch to the foot, the same as a keyseat. There is a mandrel for each common size of shaft, and the slot is deep enough to let the drift (you might call it a one-tooth broach) be below the surface. Then we have a bunch of steel strips one thirty-second inch thick that we put under the drift.

"To cut a keyseat with this outfit, the mandrel is slipped into the hole; the shoulder keeps it from going through. Then enough of the strips are put under the cutter to make it take a small bite. It is forced through with the arbor press, or if we want to do the job out in the mill, a hammer serves almost as well. Then another of the strips is laid under the broach, and a second cut taken. Pretty soon we have the keyseat through the hub in a lot less time than it would have taken to chip it, and we do about as good a job as you can with your machine."



In the absence of proper tools, keyseating can be done effectively by means of a slotted mandrel and a broachlike cutter

OLD BILL laughed at the various motions and gesticulations Jordan made in the air to illustrate the construction and use of the tool.

"It does take men like you, who have to keep the machinery running at their plants no matter what goes wrong, to get up the really good kinks in this business," Old Bill said. "Now, here in the shop, we must have tools to do most any old thing; but there you depend on your own ingenuity to get you out of a breakdown."

"Still," Jordan said, "we have to come around a good shop once in a while, or else we are likely to forget all that we learned when we worked in shops."

"The door is always open, whenever you want to take a postgraduate course," Old Bill returned merrily.

Laten came up then with word that the shaft was as good as he could get it.

"Suppose you take a little cut off the journals, and send it out to me," Jordan said. When he was gone, Old Bill, turning to Laten, remarked:

"There goes a good mechanic. He is the sort of man who looks beyond the polish and tool marks on a machine. Though he knows perfectly well that the shaft is probably still a thirty-second out, he realizes that it is as serviceable as if it were within a couple of thousandths."

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 98 to 103.

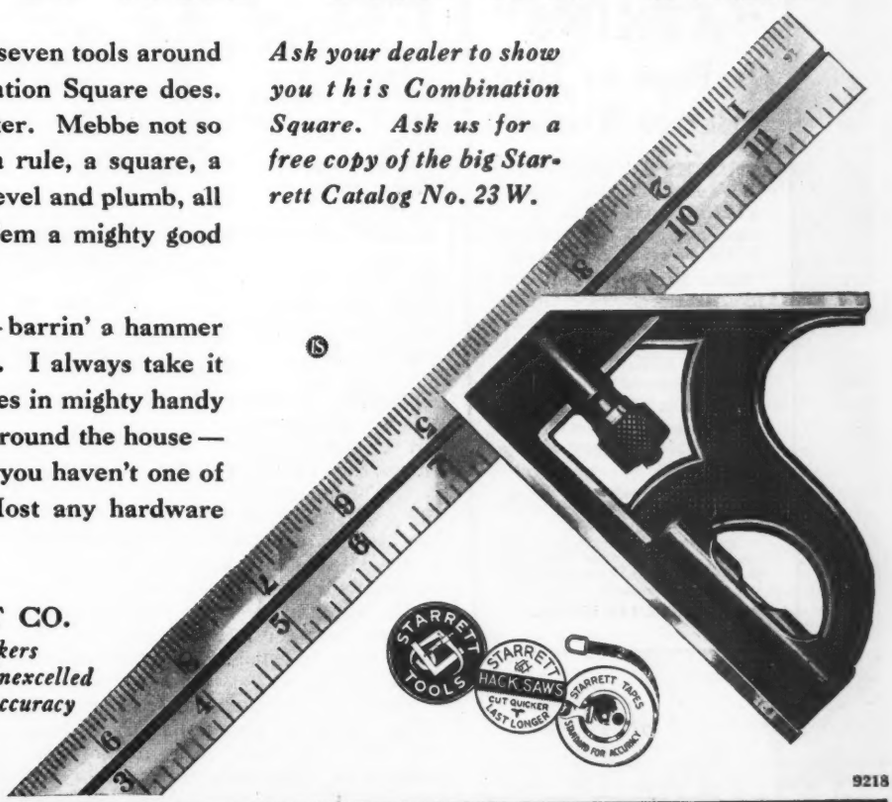
"Betcha! F' work 'r tinkering, it has 'em all beat"

"I can remember when we packed seven tools around to do what that Starrett Combination Square does. An' then they didn't do it any better. Mebbe not so good. There's a marking gage, a rule, a square, a miter, a depth gage, height gage, level and plumb, all in that combination an' each of 'em a mighty good tool by itself.

"I dunno's there's any tool I got — barrin' a hammer an' saw — that I use any oftener. I always take it down to camp with me an' it comes in mighty handy when I'm fixing things up. An' around the house — say, I wouldn't be without it. If you haven't one of 'em, go an' get one — quick. Most any hardware dealer will fix you up."

THE L. S. STARRETT CO.
World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.

Ask your dealer to show you this Combination Square. Ask us for a free copy of the big Starrett Catalog No. 23 W.



9218

Use Starrett Tools

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"ATKINS"
It Pays to Buy Better Tools!

THERE'S a "feel"—a balance—a difference—about ATKINS "Four Hundred" Hand Saw that will make it YOUR favorite saw—always. "Silver Steel" makes it hold its edge longer. "Taper Grinding" makes it cut surer, faster and easier. It's the very best saw even ATKINS can make. Really saves you money—outlasts two or three "cheap" saws. Ask your dealer or send for our folder, "Saws in the Home."

E. C. ATKINS & CO.
Established 1857
Leading Manufacturers of Highest Grade Saws for Every Use; Saw Tools, Saw Specialties, Plastering, Trowels, and Machine Knives.
INDIANAPOLIS, U. S. A.

ATKINS SILVER STEEL SAWS

The Home Workshop

Tired of Cross-Word Puzzles? Then Try Your Skill *at* These Novel Moving Letters

By ARTHUR L. SMITH

MOVABLE block puzzles may be made of cigar box wood, of three-ply veneered stock, or of other thin material. The size and method of construction may be left to the judgment, skill, and resources of the maker.

The puzzle consists simply of a shallow box to hold a number of flat blocks, which are moved about to form various designs or to place them in specified positions. The depth depends upon the thickness of the blocks. The box may be fitted either with a sliding cover or a lid to hold the blocks in place when the puzzle is not in use.

The first puzzle illustrated (Figs. 1 and 2) is adapted from an "Administration Puzzle" put forth by the New York *World* during Harrison's administration. The words used are out of date, but we can substitute other words and make one like it.

A box is made 5 in. square, inside measurement. Three of the sides should be high enough so that they can be grooved for a sliding cover, leaving a depth underneath slightly greater than the thickness of the cigar box stuff of which the blocks are made.

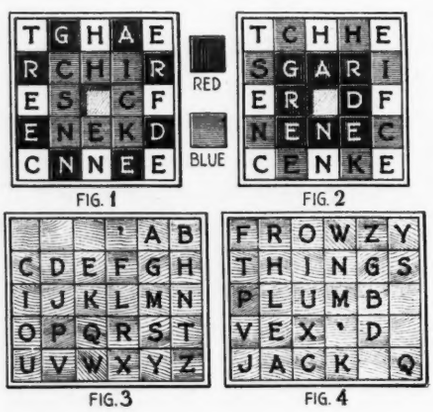

FIG. 1 FIG. 2

FIG. 3 FIG. 4

The fence (Fig. 1) has to be moved before the *gardener* can chase out the *chickens* (Fig. 2). In Figs. 3 and 4 is a similar puzzle, incorporating all letters of the alphabet

THEN twenty-five blocks are cut to about 1 in. square to fill the box. They must not fit tightly. Nine of the blocks are painted white or covered with white paper. Eight of these bear the letters THE FENCE, and one is left blank. Eight of the other blocks may be red and bear the letters GARDENER. Eight more are blue and bear the letters CHICKENS.

Figure 1 shows the blocks as they may be placed in the first position. In this case the "chickens" are in and the problem is, "How can the gardener get them out?"

The central white block is removed, which allows any adjacent block to be shoved into the vacant space. The blocks must be moved one at a time in this way until they are arranged as in Fig. 2. The blocks THE FENCE will have to be moved out of place during the process, but must be got back into the same position as they occupied before.

A variation of this puzzle can be made by using thirty blocks in a box 5 by 6 in., inside measurement. In this case the blocks may all be of one color. One bears the apostrophe, twenty-six bear the letters of the alphabet, and three are left blank.

Figure 3 shows the first position. Any one of the blanks may be taken out and the blocks moved about until they are formed into the position shown in Fig. 4. It will be noticed that this forms the sentence, "Frowzy things plumb vex'd Jack Q." In order that due credit be given, it should be said that this sentence, in which each letter of the alphabet is used only once, was evolved as a cryptogram by one known to the puzzle fraternity as "Phil Down."

As suggestions for other puzzles of this class, boxes of any size may be made and blocks of different colors used so that they can be moved about to form various designs similar to cross-word puzzle forms. Also, blocks of different sizes may be employed so that the problem would be to move one block of a certain size from one corner to another.

This is the third in a series of articles by the Rev. Arthur L. Smith, one of the leading authorities on puzzles. It might be pointed out that these puzzles, unlike the "14-15" puzzle mentioned by Sam Loyd in the May issue, can be solved with relatively little difficulty. The many readers who wrote commenting on Mr. Smith's article, "Solving the Famous Block Puzzle in Sixteen Ways," in March, will be glad to know that several puzzles of a similar type will be described in forthcoming issues. One reader wrote, "I have made twelve of the blocks illustrated by Mr. Smith—enough to give ten methods of assembling."

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The Home Workshop

An Inexpensive Mattress for a Camp Cot

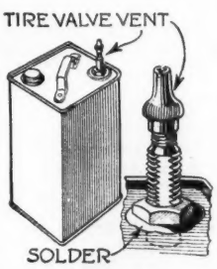
A MATTRESS for use on a small camp cot may be made from squares of excelsior packing, such as are found in egg cases, and cotton batting, inclosed in a khaki drill covering. The mattress is light and comfortable, and makes a small roll for packing.

The stuffing is excelsior and cotton batting

Cut the cotton batting to the length and width desired and lay squares of excelsior on top; then place another layer of cotton on top of the excelsior. Using a large needle and twine, tie all together, just as old-time quilts were fastened, spacing the knots about 8 in. apart. Then make the cover and repeat the tying-together process, so that the mattress will hold its shape under any amount of hard, rough usage.—ROBERT D. PEEBLES.

Air Vent for Gasoline Can

THE valve stem from an old inner tube makes an ideal vent for an oil or gasoline can, or any other tin container. Break off the valve the length required and then punch a hole in the can to be a snug fit for the stem.



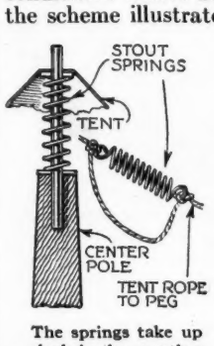
The air vent makes the pouring easier

Insert the stem, using the nut if you wish, and solder securely in place. If a gasoline can, be sure there are no fumes in the can before soldering.

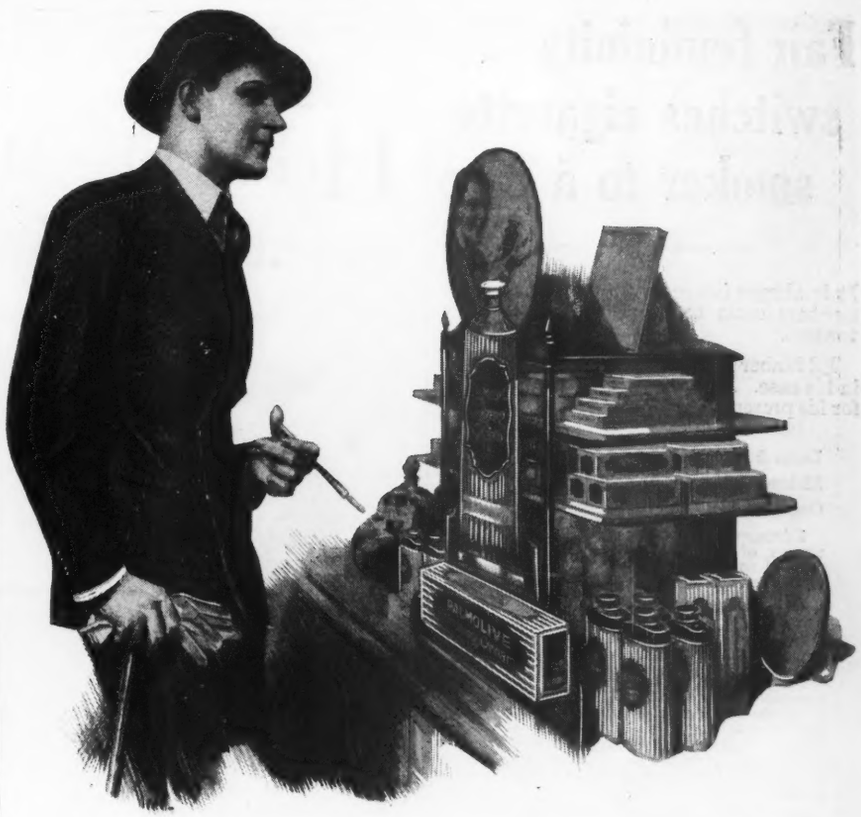
I use one such can for wood alcohol carried on camping trips as fuel for a camp stove. It allows the contents to be poured without spilling, as so frequently happens otherwise.—ERIC B. ROBERTS.

Spring Adjustment for Tent Pole and Guy Ropes

ONE of the chores of tent life is adjusting the guy ropes to suit atmospheric conditions. I have done away with this by the scheme illustrated. All the ropes of my pyramidal army tent have coil springs from an old bed, which provide an automatic adjustment. As an added feature, I also have an auto clutch spring on the center pole, which in my case is a 3-in. iron pipe 11 ft. 6 in. long, standing on a base flange. —R. D. P.



The springs take up slack in dry weather



Learn why

thousands of men are flocking to this new shaving creation

Accept, please, a 10-day tube to try

GENTLEMEN:—Your present shaving soap may be exactly fitted to your needs—or, it may be failing in one of five important ways.

Shaving is so important a thing in your life that it will pay you, we believe, to find out whether or not you are getting the utmost in a shaving cream.

80% of the users of Palmolive Shaving Cream once were wedded to rival preparations. We won them by sending a 10-day tube for trial. May we do as much for you?

5 mistakes corrected

1. *Lather too scanty* — Palmolive Shaving Cream multiplies itself in lather 250 times. A tiny bit—just one-half gram—suffices for a shave.

2. *Slow action*—Palmolive Shaving Cream acts in one minute. Within that time the beard absorbs 15% of water. And that makes a hard beard wax-like, soft.

3. *Dries on face*—The lather of Palmolive Shaving Cream maintains its creamy fullness for ten minutes on the face.

4. *Hairs lie down*—That is due to weak bubbles. Strong bubbles are essential to support the hairs for cutting. Palmolive bubbles are strong . . . they hold the hairs erect for the razor.

5. *Skin irritations*—The palm and olive oil content of Palmolive Shaving Cream leaves the face in fine condition. Men like the after-effects.

Let us prove this

We ask your permission to prove these things—to send you a tube to try. We are masters of soap making. One of our soaps—Palmolive—leads among toilet soaps of the world. We have worked hard to excel in a Shaving Cream. We made up and tested 130 formulas before we attained our ideal.

Do us the kindness to mail this coupon, for your sake and for ours.

THE PALMOLIVE COMPANY
(Del. Corp.), CHICAGO, ILL.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well-groomed look. Try the sample we are sending free with the tube of Shaving Cream. There are new delights here for every man who shaves. Please let us prove them to you. Clip coupon now. 3307

10 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-1202, The Palmolive Company (Del. Corp.), 3702 Iron Street, Chicago, Ill.

Residents of Wisconsin should address The Palmolive Company (Wis. Corp.), Milwaukee, Wis.

.....

.....

Print your name and address clearly

Fair femininity switches cigarette smoker to a pipe

It is always interesting to hear how pipe smokers come to discover their favorite tobacco.

Ed Maher frankly admits there's a "she" in his case. And to her he gives the credit for his present pipe-smoking enjoyment.

Larus & Bro. Co.,

Richmond, Va.

Gentlemen:

I happen to be a student at the University of California, and since I first started to smoke I have always smoked cigarettes.

One day SHE said to me, "Ed, dear, why don't you smoke a pipe? I think those long straight-stemmed pipes are so much more manly-looking than cigarettes."

So, naturally, I had to buy a long-stemmed pipe and a can of—well, we'll call it "Blubs Mixture tobacco." Immediately with a certain feeling of pride in my new pipe, I "lighted up" and proceeded to have my tongue bitten. I tried almost every brand I had ever heard of but none satisfied me.

Sadly, I had to confess to HER that as a pipe smoker I was a good dietitian.

"Did you try Edgeworth?" she asked. "That is what dad smokes, and he's always smoked a pipe."

So to make a long story short, I was forced to try Edgeworth, and all that I can say is that if every fellow that has tried to accustom himself to a pipe, started with Edgeworth, there would be very few that would go back to cigarettes.

Yours sincerely,
Ed Maher, 1731 Hayes St., San Francisco.

Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality.

Write your name and address to Larus & Brother Company, 108 S. 21st Street, Richmond, Va.

We'll be grateful for the name and address of your tobacco dealer, too, if you care to add them.

Edgeworth is sold in various sizes to suit the needs and means of all purchasers. Both Edgeworth Plug Slice and Edgeworth Ready-Rubbed are packed in small, pocket-size packages, in handsome humidors holding a pound, and also in several handy in-between sizes.

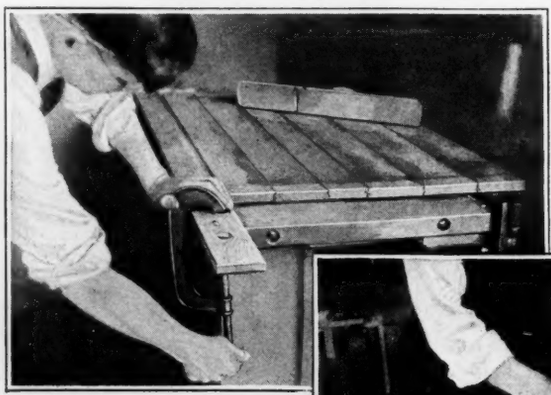
To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Edgeworth Ready-Rubbed for the same price you would pay the jobber.

On your radio—tune in on WRVA, Richmond, Va.—the Edgeworth station. Wave length 256 meters.

The Home Workshop

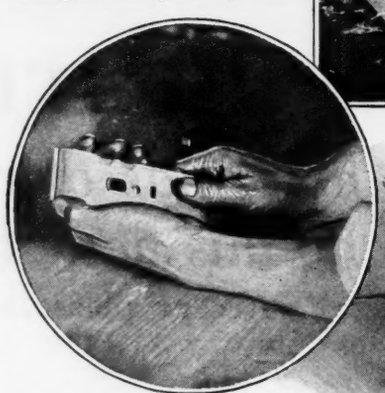
Here's the Way to *Smooth* a *Hardwood* Surface

By Emanuel E. Ericson, *Noted Manual Training Authority*

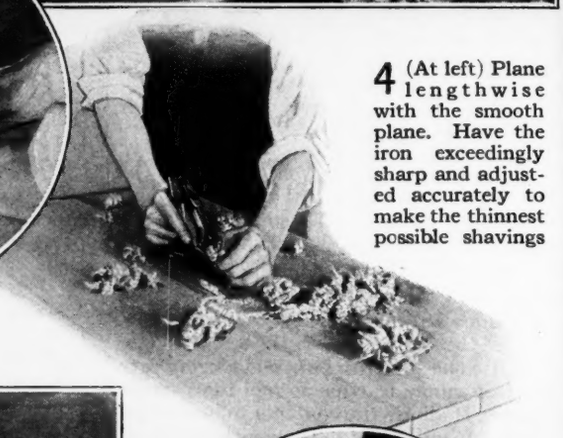


1 If you have a glued-up hardwood surface to plane, first support it firmly on the bench against one or two strips thinner than itself. It is essential, too, that the bench be absolutely rigid. If your bench happens to give when pushed against, brace it in any convenient way

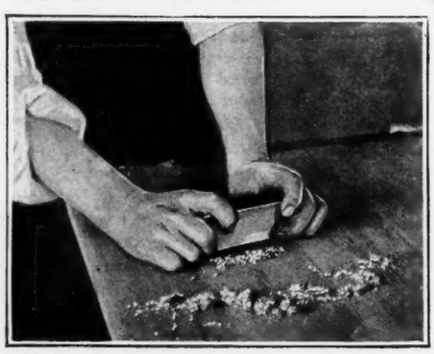
2 (At right) Level off diagonally and then straight with a jointer plane



3 (Above) Adjusting smooth plane blade and back iron. See note below



4 (At left) Plane lengthwise with the smooth plane. Have the iron exceedingly sharp and adjusted accurately to make the thinnest possible shavings



5 Scrape the surface with the grain, but at a slight angle. Sharpen the cabinet scraper as shown in these columns in the July, 1925, issue

Note: In adjusting the smooth plane, hold the sharpened iron as shown in Fig. 3 above and push the cap forward with the thumb until the cutting edge appears no wider than a thread. Hold it in place with the left hand and tighten the screw

6 Next sandpaper with No. 1, ½, or 0 paper, depending upon the wood and quality of surface desired. Wrap the paper around a block and make straight strokes back and forth with the grain. Crosswise or circular strokes are certain to leave scratches that will later show through the polish

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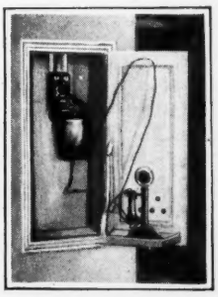
The Home Workshop

Compact Telephone Cabinet Built into Wall

THIS telephone cabinet may be made by anyone who is handy with tools. It consists of a box with a wall-board back that is set into the wall between two partition studs after the plaster has been cut out with a cold chisel and the laths severed with a compass saw.



The cabinet holds both house and long distance phones

In this instance both the house intercommunicating phone and the outside telephone are located in it. Notice that a ledge is provided on the inside of the door to carry the telephone, and that holes are drilled in the door in order that the bell may be heard more readily.—R. M. S.

Zinc-Topped Kitchen Table

(Continued from page 71)

bodily when the table is to be moved or cleaned inside.

The lower part is one large compartment for the storage of both foods and kitchen utensils. It was assembled by joining top and bottom rails all the way around to four legs, each 2 in. square. The rails were made 2 in. wide and 1 in. thick, and all of them were grooved on one side for the panels except the two in the front of the compartment.

The tops of the legs were left extending 1 in. above the panels. Shoulders 1 in. deep were cut on the front and back of the legs, and the upper part of the table rests on these shoulders. Casters were provided.

The top of the table was made by assembling eight rails around four leg pieces, each 2 in. square and 8 in. long. It was divided for three drawers, runners being supported by the lower rails at the front and back of the table.

For the top of the table, which is 30 by 54 in. and 2 in. thick, two thicknesses of lumber were used, one running lengthwise and the other crosswise. The upper layer was planed quite smooth and nailed down well. A piece of zinc was used for covering the top. Zinc is soft, and no trouble was experienced in bending the edges smoothly. The edges were tacked to the under edges of the table with brass-headed nails.

For hardware, two pair of hinges, three drawer pulls, one cupboard turn, and an inside cupboard catch for one of the lower doors were needed. They were finished in lemon brass color.

The piece was finished in white enamel, but one of the new lacquers or a stained and varnished finish could be used for a table of this type, if preferred.

I HAVE made one of the Pirate Ship models, and it certainly is an ornament that never fails to attract attention.—E. F., Altamont, Ill.

Friendly but Friendless

SICK at heart he watched them go. Last year he was always asked to join this merry group, but now the invitations were becoming fewer and fewer. He touched his face gingerly in miserable speculation. Could it be . . . . . ?

* * *

A great many young men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

Clears the Skin. Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use. After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the dirt and skin impurities. Result—a clean, healthy skin with clear, glowing color.

Use Pompeian Massage Cream regularly at home—then you'll get the full benefit. At all druggists.

SPECIAL INTRODUCTORY OFFER

⅓ of 60c jar for 10c

For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits. Positively only one jar to a family on this exceptional offer.

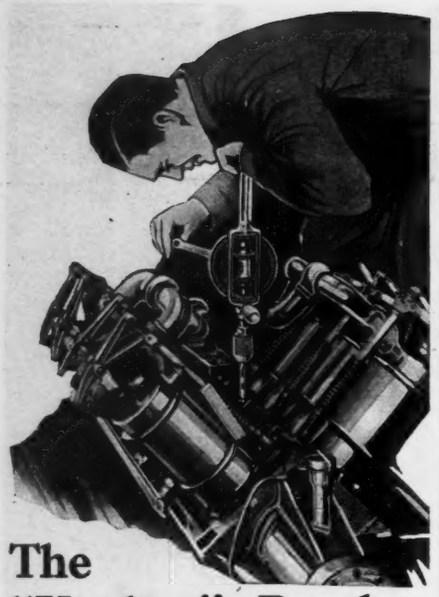
THE POMPEIAN CO., Cleveland, O., Dept. 49

Gentlemen: I enclose a dime (10c) for ⅓ of a 60c jar of Pompeian Massage Cream.

Name .....

Street Address .....

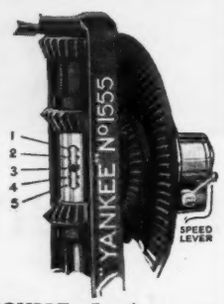
City ..... State .....



The "Yankee" Ratchet makes jobs easier

A finger touch on Ratchet Shifter gives any one of five adjustments.

1. Plain Drill
2. Left-hand Ratchet
3. Right-hand Ratchet
4. DOUBLE Ratchet
5. Gears Locked



WHEN set on DOUBLE Ratchet, any movement of crank, back or forth, however slight, sends drill into work. This saves lost motion and, therefore, lost time.

The five ratchet adjustments and two speeds make this "Yankee" Drill handy and fast.

Speed changes made instantly without removing drill from work. Just shift lever at base of hub.

No. 1555

No. 1555 (illustrated), 3-jaw; No. 555, 2-jaw. Holds ½ in. Drills. No. 1545, 3-jaw; No. 545, 2-jaw. Holds ⅜ in.

For smaller drilling jobs use "Yankee" Ratchet Drill No. 1530, with five ratchet adjustments.

Some other "YANKEE" Tools

Ratchet Screw-drivers
Ratchet Bit Braces
Automatic Push Drills
Automatic Feed Bench Drills
Vises, Removable Base

Dealers everywhere sell "YANKEE" Tools

"Yankee" on the tool means the utmost in quality, efficiency and durability.

Write for FREE "Yankee" Tool Book, of interest to those who love good tools

North Bros. Mfg. Co., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

Ways to Build a Good Float

How to Make One with Barrels That Will Last for Years

By HENRY S. LARABY

FIVE members of the Bayside Canoe Club were seated on the end of their dock, basking in the sunlight of the first really warm June day of a cool and backward season.

"Well, boys," spoke up Fred Nelson, the club's commodore, "if we're going to build that swimming float, we had better take a run over to Captain Graham's and see if he has figured out a good plan for us to follow."

Captain Graham, always forehanded in things pertaining to fishing and boating, was mending a crab net.

"Yes, I sketched out plans for two different floats," the Captain assured the eager members of the canoe club; "one is fourteen feet square (see Fig. 1) and the other ten feet (see Fig. 2)."

"But these are barrel floats," said Nelson. "Why not make a plain raft?"

"Because a spar float, made up of two or more large timbers with planks nailed across, is very heavy. No matter how much you paint it, the wood will soak up the water and set lower and lower each day. Barrels are easy to get, the necessary planks can be gotten in any lumberyard, and the float will set high and will not be unduly heavy. All you need to build it are saw, hammer, brace, half-inch wood bit, heavy two-inch chisel, and a monkey wrench.

"You will notice that the larger float has a frame which extends down below the barrels. This is to protect them when the float is hauled out, or if it rests on the bottom at low tide, or if it has to be beached for repairs. Without it, the barrels might get crushed or damaged sufficiently to make them leak. You can leave it off the large float or put a similar frame around the smaller float. For my part, I would put it on in every case.

"You will have to use the strongest possible construction. You will see that I have arranged the timbers to make angles wherever possible—the angle-iron shape being about the strongest and simplest one can have.

"BUILD the float as near the water's edge as possible for ease in launching. Decide on whether you will use wooden oil barrels or steel oil drums, but pick good ones and, of course, they must be water-tight. Next order your timbers and flooring. Cut the timbers to the proper length, pair them up and bolt them together to make wooden angles."

"That will be quite a job, won't it?" asked Nelson.

"Not if you go about it right. I would mark each pair when cut by driving a small nail halfway in—one nail in each of the first pair, two nails in the second pair, and so on. Then clamp each pair together in turn and bore the bolt holes right through with a half-inch bit. Next cut out the timbers that are to hold the barrel. Don't bolt any together, however, until you have soaked them all over with paint. Pay special attention to the ends.

"After two or three days, give them all another coat. Don't

(*Continued on page 81*)

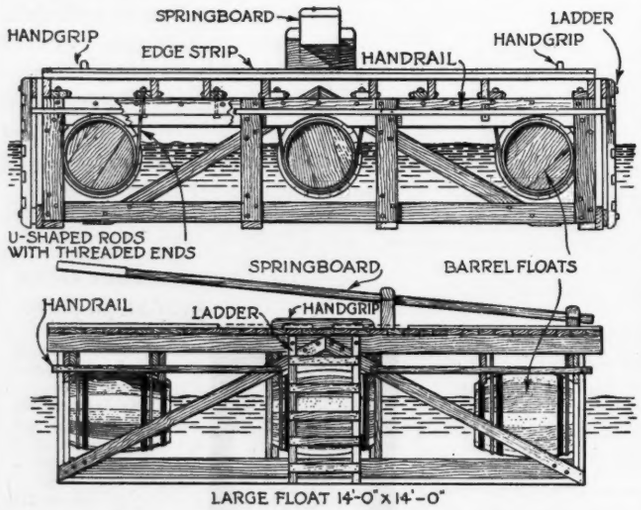


Fig. 1. Side and end views of a float supported by nine barrels or oil drums. Note the heavy bracing framework below the water

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The Home Workshop

Ways to Build a Good Float

(Continued from page 80)

forget to run the paint well through the bolt holes. This painting is very important, and five or ten dollars' worth of paint will make your float last three years longer at the very least.

"Block up the two end timbers on blocks or a sawhorse, high enough so that you can bolt on the protecting framework, if you decide to have it. Next bolt the two side timbers to the ends. Now you will have a square frame and you can bolt the other timbers in place.

"Hang the barrels in their places and fasten them by means of rods, which should be threaded at each end. Paint the nuts, threads and bolts as you go along.

"When the main frame is built, bolt the protecting frame around and nail on the two-by-sixes that run underneath. They are to steady the whole and to allow the float to be rolled to the water.

"Paint your flooring before cutting it in lengths. Nail it in place, but don't drive the pieces too closely together, for

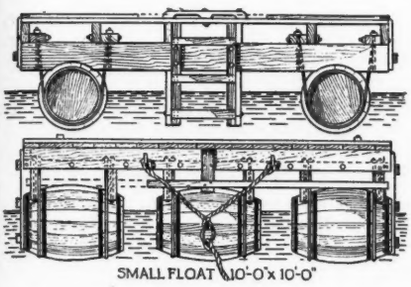


Fig. 2. A float with only six barrels. Side frames like those in Fig. 1 may be added

they will swell. After the nailing is done, saw off the waste and soak the finished ends with paint. Don't forget a handrail around the float at the top and another at the water's edge.

"The final coat of paint should be red or green below the water, but above the water the floor should be white or a light color so as to be visible for boating at night.

"You can moor the float by an anchor or by stakes. The stake method is the cheapest, but it is hard to drive down the stakes.

"To make an anchor, use a packing box about two by two by three feet as a cement mold, and cast in it an old brass pipe or shaft bent to form a loop. You will also want to add a springboard and ladder, but that is a simple matter."

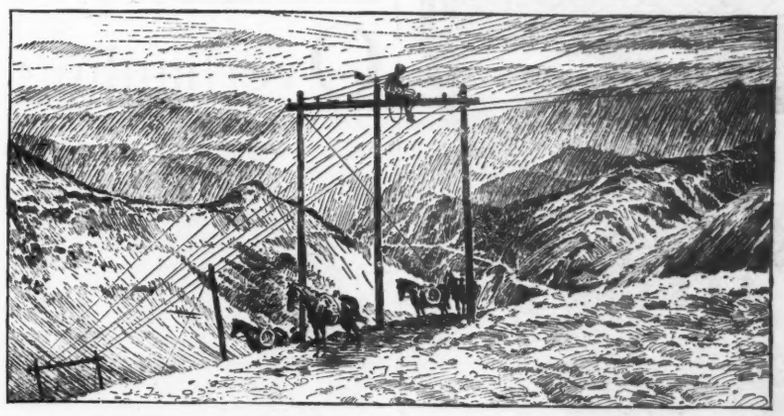
"How much material shall we need?" Captain Nelson asked.

"I made a rough list at the time I drew the sketches," the old sailor replied. "Here it is."

The list was as follows:

For the smaller float, 6 pieces 2 by 8 in. by 10 ft.; 10 pieces 2 by 6 in. by 10 ft.; 125 sq. ft. 1¼ by 4 in. flooring; 4 pieces 1 by 2 in. by 10 ft.; 3 pieces 2 by 4 in. by 12 ft.; 2 pieces 1 by 3 in. by 14 ft. Sixteen ½ by 12 in. carriage bolts, nuts and washers; thirty-two ½ by 9 in. carriage bolts; eight ⅜ by (Continued on page 88)

Telephone line over the Rocky Mountains



The Builders of the Telephone

SPANNING the country, under rivers, across prairies and over mountain ranges, the telephone builders have carried the electric wires of their communication network. Half a century ago the nation's telephone plant was a few hundred feet of wire and two crude instruments. The only builder was Thomas A. Watson, Dr. Bell's assistant.

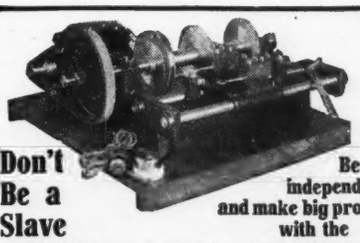
It was a small beginning, but the work then started will never cease. In 50 years many million miles of wire have been strung, many million telephones have been installed, and all over the country are buildings with switchboards and the complicated apparatus for connecting each telephone with any other. The telephone's builders have been many and their lives have been rich in romantic adventure and unselfish devotion to the service.

Telephone builders are still extending and rebuilding the telephone plant. A million dollars a day are being expended in the Bell System in construction work to provide for the nation's growing needs.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

BELL SYSTEM

IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION



Don't Be a Slave

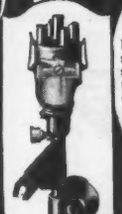
Be independent and make big profits with the

BEISSER KEY MACHINE

You can start a business of your own, no experience necessary. Only machine that will make first keys without taking lock apart. Makes a dozen duplicate keys per minute. Write Today for Full Particulars.

BEISSER KEY MACHINE CO.
409 Fort Street, East Detroit, Michigan

Delco Ignition for Fords At A New Low Price



Now you too can equip your Ford with the amazing new Delco ignition at only $13.00. Give your Ford high-priced car performance. New speed! A fatter, hotter spark. Easier starting. And the saving in gas will be pleasing, too. With Delco coil, $5.50 extra. Write for information or better yet, send money order, draft or express order for immediate shipment. Address

UNITED MOTORS SERVICE
INCORPORATED
Detroit, Michigan
Dept. E

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No.
414
The first
MILLERS FALLS
Electric
Drill

FOR fifty years Millers Falls Company have made hand, breast, chain and bench drills.

To take up the manufacture of portable electric drills was a natural step forward. It depended on one thing—the development of an electric tool of true Millers Falls quality.

Here it is—the first number of a series. Look for it in hardware and automobile supply stores. It's a fine tool—what more can we say than that it *belongs* to the Millers Falls group?

MILLERS FALLS COMPANY
Millers Falls, Mass.
28 Warren Street, New York
9 So. Clinton Street, Chicago

MILLERS FALLS TOOLS
SINCE 1868

The Home Workshop

Overhauling *Our* Motor Boat

Getting Ready for Summer Cruising—Precautions against Break-downs—Hull Repairs

By HENRY LOWE BROWNBACK

Mr. Brownback is a specialist in marine motors. He has provided the power plants for some of the fastest small craft plying the waters in and around New York City

MOTOR BOATING is so splendid and invigorating a sport that boat owners invariably take a keen personal interest in the repair and maintenance of their boats. A man may be willing to leave the upkeep of his auto entirely to a service station, but he feels his motor boat deserves that sympathetic handling and patient attention to details that no one but himself can give.

This article is written with such an owner in mind—a man who has an average small boat. The thought of economical procedure has been kept paramount.

Before actual operations in overhauling a motor boat are commenced, it is always well to make out a complete list of every item to be attended to and then to arrange these items in logical order on a neatly prepared sheet. Cross them off one by one as they are attended to. This saves time, insures a completely finished job, provides a check on any trouble that may arise, and, most of all, gives wonderful peace of mind undisturbed by "Oh!-Did-I-forget-that" thoughts.

THE logical time to begin is really at the haul-out period in the fall. At that time the boat should have the underwater portions scraped, scrubbed clean and washed with fresh water before the marine growth has had a chance to harden. After that the bottom is given a coat of copper paint.

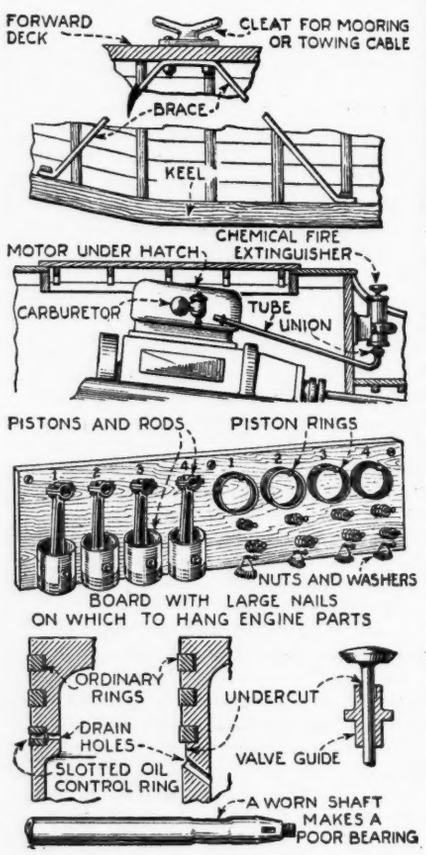
At this period the engine should be removed and stored where it can be overhauled in spare hours during the winter. The operation will take from twenty-five to several hundred hours if a really thorough job is to be done. It is not advisable to attempt to do it in an ordinary cellar, where working surfaces are exposed to moisture or ash dust.

Immediately upon removing the engine, take up the floor boards, clean the bilges thoroughly, and scrub out the inside of the boat. If kerosene is required in this operation, use as little as possible and wipe it out thoroughly, scrubbing afterward with washing soda and water. It is a good plan to remove the old paint and give a good coat of lead paint at this time.

As the engine makers publish instruction books, I am not going into details, but will offer a few hints. First, drive into a board a series of 4-in. spikes, numbered for each cylinder. Then hang the piston rings, connecting rods, pistons, and other parts on these pins. Don't chuck them helter-skelter into a box.

Clean all parts and, where adjustments are provided, test carefully for wear. These adjustments can be made during the assembly, but where bushings, pins, and the like are worn badly, they must be replaced. If these parts are ordered early, much delay will be saved, and careful fits can be made.

If the exhaust valve stems have been sticking, to undercut the top of the guide about .010 in. for (*Continued on page 83*)



Braces for mooring cleat, a fire extinguisher installation, and other kinks for boat owners

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The Home Workshop

Overhauling a Motor Boat

(*Continued from page 82*)

from ¼ in. to ⅜ in. will generally cure it.

The only other points to be cared for in the ordinary power plant are to flush out all oil mains, to test valve springs for weakness, and clean exhaust ports in two-cycle motors.

In putting in new pistons, weigh them in sets; they should not vary more than 1/5 ounce per pound. Also, see that piston ring ends have plenty of end clearance (about .003 per inch bore). Another point often overlooked is cleaning the carbon from the under sides of piston heads. Piston pins should fit snugly in the pistons. If the latter are of aluminum, they should be heated before fitting the pins, which should be from .0015 to .002 in. larger than the holes.

PISTONS that "pump" oil often can be cured by undercutting the last ring and draining the undercut with return holes.

If your engine has been getting "tired" or sluggish after a run of from twenty minutes to half an hour, fit a scavenger pump to draw the oil from the oil pan and carry it to a tank fitted with a cooling coil. From there the pressure pump should draw it and force it into the bearings. The scavenger pump should be of at least 50 percent greater capacity than the pressure pump.

In all cases clean out every part of the oiling system, sump, splash trays, if splash oiling is used, and drilled passages in crankshafts. This is most important, as the life of an engine depends entirely upon efficient lubrication.

In making fine lap fits, a well-known household cleaning cake with kerosene is a safe and excellent abrasive.

After the repairs are finished, paint the engine with some good enamel, polish the bright work, and give it a coat of clear lacquer, and oil or grease all working surfaces. All this should be done at the hauling-out time.

Now we come to hull repairs. First, go over the wood with the end of a sharp jackknife to find soft spots or rot. Tap the wood with a hammer to discover any loose fastenings. Replace any defective wood.

THE danger point for planking is the plank running next to the keel. If the planking is in good shape, we may turn our attention to the caulking, if our boat is caulked. If this is bad, strip out the loose cotton, run a V-shaped tool along the groove, and then recaulk. In order to do this properly, go to some boat yard and watch an expert. Notice how much cotton he uses, how he twists it, lays it in the groove and taps it home. After caulking, give the seams a coat of priming paint, putty smooth with white lead, and paint the entire hull with a priming coat.

Engine beds should be examined carefully for loose or defective fastenings and for any movement. They must be securely bolted and fastened so as to distribute vibration and load. (*Continued on page 88*)

No school or home work-bench is complete without them

SARGENT Planes are tools of the master craftsmen, but so moderate in cost that they should be on every school and home work-bench. They are beautiful planes — in design, materials and finish. They are efficient in operation, simple in adjustment, so durable in construction that you may never have to replace them.

Sargent Auto-Set, the larger of the two, has an exclusive time and trouble saving feature. The cutter of edge-holding chromium steel may be removed, sharpened and replaced without changing original adjustment. Back in place, the cutter is as rigid as can be, even when cutting across or against the grain or over knotty surfaces. For end work and the smaller jobs of finishing, you can't beat the Sargent Steel Block Plane. With these two planes, practically every need for finishing tools is met and professional looking jobs are assured. At hardware stores. Write us for booklet.

SARGENT & COMPANY, *Manufacturers*
50 Water Street, New Haven, Conn.

Sargent Steel Block Plane No. 5206

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SARGENT
PLANES

Make More Money

Read the Money Making Opportunities on pages 104 to 127 of this issue.

"World's Handiest Calculator"

(NEW POCKET SIZE)

ADDS : SUBTRACTS : MULTIPLIES DIVIDES

NEW Will do the work of a large $300 adding machine. Capacity 99,999,99. Total visible at all times. Clears with pull of the finger. NOT A TOY, but an indestructible portable machine GUARANTEED five years. So compact that it fits in vest pocket. Accurate. So simple a child can operate it. Instructions with every machine Everybody should carry one for figuring as it is suitable for any use where numerals are dealt with.

FREE TRIAL : SEND NO MONEY

Just write "Send me a Baby Calculator" and give your name and address. We will ship Calculator immediately. On delivery pay postman $2.50 plus few cents postage. (If outside U. S. send cash). If not satisfied after 10-day trial, you get your money back. THOUSANDS OF SATISFIED USERS. This is lowest priced practical portable calculator made. "Why pay more for inferior imitations?" Order from this ad today.

$2.50 TOTAL COST

AGENTS: Every business firm, man or woman will buy this machine on sight. BIG COMMISSIONS.

BABY CALCULATOR SALES CO., P. O. Box 1118, Chicago, Ill. Dept. 50.

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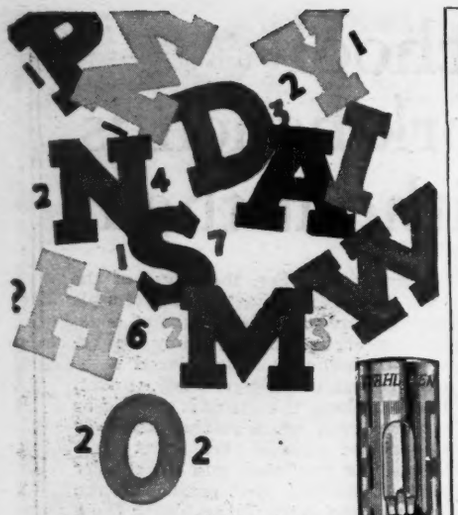
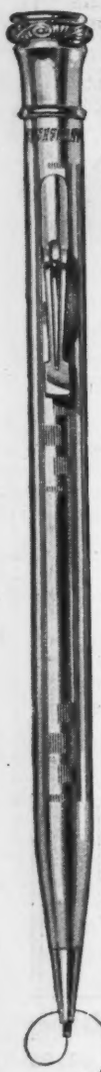




School days end—
Commencement is here —and workaday life is beginning. Give the graduate a gift that carries both sentiment and practicality.

Give something that bridges these momentous days between theory and reality, and helps translate the chance thought into sure advancement.

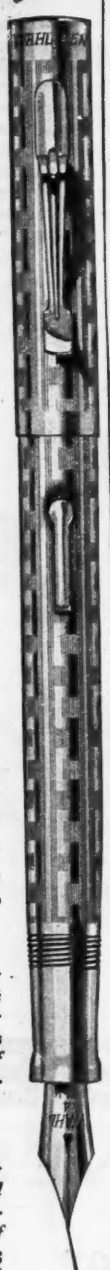
Give the gift that better than any other teaches Success' first lesson:

PUT IT ON PAPER!

Success waits on the man who keeps in line with his thinking those best friends of an active brain — EVERSHARP AND WAHL PEN.

There's an Eversharp for you in any style and size you want. This one, the popular standard gift and business model, with 18 inches of lead up its sleeve, gold-filled at $5

Perfect writing mate for Eversharp is the new Wahl Pen. Finely balanced; beautifully and lastingly made of precious gold and silver; precisely designed to match your Eversharp, in combination sets, or individually at $8



Put it on paper

EVERSHARP and WAHL PEN

© 1926, The Wahl Co., Chicago Canadian Factory, Toronto

The Home Workshop

ARCHERY—The Latest Sport

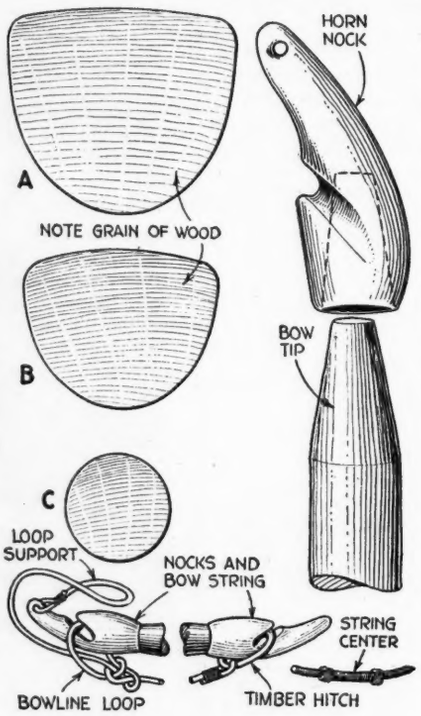
(*Continued from page 69*)

governs the bow makers and fletchers of civilization.

What forms a most interesting and little known bit of American history is the fact that the southern Indians used charred cane or bamboo with which to make their arrow points. The charring of the cane hardened it, and with arrows pointed with this material the savages were again and again able to pierce the armor of the Spaniards, and, at least in one instance, they pinned the armored leg of a Spaniard to his horse's side by sending the arrow through the armor and burying the head in the horse's body.

The eastern Indians of olden times apparently used a much longer bow than those made in the West. Captain John Smith and his companions found the coast Indians using bows nearly as long as their own English long bows and quite as powerful. The arrows were tipped with chipped flakes of flint, quartz, shale, or bits of hardened bone.

THE accuracy with which the Indians could shoot with their home-made bows was quite disturbing to English, French and Spanish adventurers on this continent. Since their bows were better adapted to our land than the imported English bows, I see no reason why we should not model our bows after the redman's bow instead of modeling them after Robin Hood's.



Cross-section of a bow at places marked A, B and C in drawing on page 69; details of the horn "nocks"; knotting a catgut bowstring

It is true, however, that a number of our pioneers, scouts and buckskin men of the frontier did use the English long bow for two practical reasons; the material for their arms was supplied them by the forest, and the wang of a bowstring did not attract as much attention as did the crack of a "Kaintucky" Lehman or New Purchase rifle.

In the recent war in Mexico, Villa had a whole regiment of Yaqui Indians armed with bows and arrows, who used these weapons in battle.

Catlin, the artist, the Grand Duke Alexis of Russia, and Francis Parkman, all are witnesses to the truth of the story of the Indian's shooting an arrow through the body of a live buffalo so that the shaft came out on the opposite side of the animal and fell upon the ground.

When the Santa Fé Trail was first traversed by the pioneers, these hardy buckskin-clad men discovered, to their sorrow, that it oftentimes happened that their small-caliber rifles were not a match for the Indian bows, and not nearly so effective in the hunting of big game. While the trappers and plainsmen were constantly having their rifles re-bored to the standard caliber of thirty-two balls to the pound, the Indians were increasing the strength of their bows until they averaged about a sixty-pound pull; this bow they could use handily on horseback.

In attacking a caravan, the Indian would throw himself into a loop of braided horsehair on the off-side of the horse and, shooting from below the neck of the horse, send his arrows with disturbing accuracy at his adversary.

BUT THE plainsmen met this trick by fighting in pairs. One would draw a bead with his long rifle on the horse and, when the horse dropped, the other plainsman got the Indian as the latter was disengaging himself from the fallen animal. It was a great game! The survival of the fittest in animals, weapons and men.

I know of several old plainsmen, quiet, unassuming old chaps, who confessed to such an ardent admiration for the Indian bow that, when they killed an Indian whose bow was exceptionally good, they appropriated it and carried it with a quiver full of arrows over their shoulders, relying upon it to save them powder and lead when those commodities were scarce.

Old Jim Carter told my assistant that many times he had killed an Indian with a bow and arrow, much to the consternation of the Indian's companions, who, finding the body pierced with an arrow from a distant tribe, could not understand its presence.

Many varieties of wood were used for bows; for example, osage, hickory, ash, mulberry, cedar, witch hazel, walnut, and even the despised willow. Almost any springy wood can be used for a bow, particularly if it is backed and bound with sinew. The old (*Continued on page 85*)

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The Home Workshop

Archery—The Latest Sport

(*Continued from page 84*)

plains bow, however, was made from a choice stave of osage orange or hickory, well seasoned and worked into shape so carefully, that every advantage of its grain and elasticity was considered.

As a rule, the old men of the tribe were the bow makers, and never a bow left their hands that was not as nearly perfect as their skill and ingenuity could make it. No bow was carelessly made, not even the toy ones for children; some of these were miniatures of the man's bow, only falling short of it in strength and length.

An Indian cared for his bow as a white man did for his rifle, well knowing that any accident befalling it might mean hunger, starvation or the loss of his scalp and life. Usually the bow was carried unstrung in a case of panther skin or heavy buckskin, often beaded and ornamented with porcupine quills. To the bow case was fastened a quiver of the same material, of a capacity to hold about fifty arrows. War parties often carried quivers that would hold a hundred arrows. In the excitement of war and chase, the Indians shot as rapidly as the opportunity of a hit afforded.

There used to be a game upon which the Indians gambled. Someone would bet that he could shoot the most arrows into the air, the last one leaving the bow before the first one fell to the earth. The record for this, I believe, is eight arrows. If you have an idea that this required no particular skill, try it yourself some time, and I will admit that if you have three arrows in the air at one time you are doing "mighty" well.

Toward the latter days of the Santa Fé Trail, the western trading posts sold hickory staves, which were bought by the Indians for bows and by the white men for ramrods and (*Continued on page 86*)

The New Archery Games

ARCHERY GOLF resembles regular golf. It is played by shooting from target to target, spaced from 30 to 200 yds. apart. The 9 or 18 targets are bags of double burlap 2 ft. in diameter, stuffed with straw. A white ring 4 in. in diameter is painted in the center, surrounded by a ring 5 in. wide of red and an outer 5-in. ring of blue. An arrow in the center scores 0, in the red, 1, and in the blue, 2. The targets are the only equipment needed to set up a course. Oakland, Calif., was one of the first cities to have such a public course.

Another game is known as "roving." The leader of a group of archers selects some object at a reasonable distance as a target and shoots at it, followed in turn by his companions. The one whose arrow strikes closest to the center of the target then selects another target farther away, and in this way the group roves on. Each time an archer wins the privilege of selecting a target he scores a point.

Detailed rules for regulation archery target contests, as well as for these games, can be obtained at any well equipped sporting goods store.

NERVE STRAIN

The Cause of Nervous Indigestion, Auto-Intoxication, Blood Poisoning

OF ALL the things that injure health, straining the nerves is more dangerous than all others combined. It weakens the nerves, paralyzes the organic forces, plays havoc with the mind; and is the cause of innumerable dangerous ailments.

Nervous Indigestion

Nerve strain is especially harmful to the stomach and bowels, causing nervous indigestion, sluggish bowels, and kindred disorders. This, in turn, fills the blood with dangerous poisons. Why and how this occurs can be easily understood. Undigested foods in the stomach and bowels ferment and decay. This putrefaction develops gases and certain toxic poisons, just as does any putrefying matter, be it inside or outside of the body. These poisons are absorbed by the blood, which transmits them to every part of the body. This self-poisoning is termed Toxemia or auto-intoxication.

Toxemia

Toxemia impairs the blood circulation, causing high or low blood pressure, dizziness, kidney trouble, mental and physical restlessness, sleeplessness, and uneasiness of the mind. It lowers the disease-resisting powers and leads to many diseases, especially colds, pneumonia, and tuberculosis.

Toxic poison has the same effect internally as would a drop of acid placed on the skin. It burns and irritates, that is, it causes pain. All bodily pains, not due to local injury or infection, are due to toxic poisons. This includes headaches, neuralgia, neuritis, rheumatism, backaches, pains in the region of the heart, in the chest, etc., etc.

Stomach Ulceration —Cancer

As stated, putrefaction of undigested food develops gases, which is indicated by belching and bloating of the bowels. These gases expand the stomach like a toy balloon, causing severe pressure on the heart and lungs, which, in itself, is often fatal. Frequent dilation of the stomach in time develops a pocket at the bottom where food remains for days to decay and develop irritating poisons. This leads to local ulcers, and in many cases leads to cancer, a disease that is killing many thousands annually.

Dieting Ineffective

Millions of people try to avoid Toxemia by abstaining from foods that readily ferment and decay. While dieting is helpful, it is, at best, but a "dodge," and not a cure. The *only cure* lies in avoiding Nervous Indigestion, and that cure must begin *through the nerves.*

Do You Know—

That it is Nerve Force that gives you Mental Power and Character?

That your Nerves govern your entire body, in fact, your whole life?

That when your Nerves become weak, every muscle and organ become correspondingly weak?

That mental strains, especially worry, fear, and self-consciousness, paralyze the Nerves that control the stomach and bowels?

That Nerve Strain will wreck your Health more rapidly than any other abuse?

Do You Know—

How to develop your Nerve Force?

How to RELAX and CALM your nerves?

How to counteract Worry, Fear, Anger, Jealousy and similar nerve-killing emotions?

How to avoid Nerve Tension, Nervousness and loss of Nerve Force?

Read *Nerve Force*, where all these important points are fully explained.

PAUL von BOECKMANN

Author-Lecturer-Scientist, whose various books on the Nerves, Breathing, Psychology and Health have reached the highest plane during the last 30 years. His books have been translated in several foreign languages by scientists of various countries.

I write authoritatively on this subject, as I have made a life study of nervous people and their ailments and weaknesses. During the last 30 years I have had far over 100,000 such cases under my observation and care, of which hundreds were treated in collaboration with leading medical scientists. No other man has had so great an experience as I in this specialty, nor has had the opportunity to test so widely the efficiency of any advance made in this science.

An Important Book

I have written a book, entitled "NERVE FORCE," which discusses this vital subject in detail and explains in simple language how we strain our nerves, paralyze the vital organs, and what we must do to restore them to normal condition. The cost of the book prepaid is only 25c coin or stamps. Address me, Paul von Boeckmann, Studio 164, 110 West 40th Street, New York City.

This book is not a catch-penny pamphlet. It is a dignified treatise, free from exaggeration and "bunk." It is on file in many Public Libraries, Sanitarium Libraries, and at the National Medical Library at Washington, D. C. The book "Nerve Force" contains 64 pages of important information and practical advice. Over 1,000,000 copies have been sold in past years. Whether or not you have trouble with your nerves and stomach, you should read this book, which you may do at my risk. If it does not meet your fullest expectations, your money will be refunded, plus your outlay for postage. Or, you may pay for the book after you read it.

So send for the book today. Strengthen your nerves and be immune to Nerve Strain and its trail of dangerous consequences.

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This is easy to repair!

WHEN the hook comes out and the clothes fall in the dirt, get your can of

SMOOTH-ON NO. 1

roll some into a putty, plug it into the old hole and screw the hook back in. Give the repair a couple of hours for the Smooth-On to harden like iron, and the hook will be tighter than ever.

You can get the same good results with loose bracket and holder screws in tiled or plastered bath room walls, hooks in the kitchen and clothes closets, etc.

The best way to put a hook, cleat or bracket screw into a tile, brick or concrete cellar wall is to drill a hole larger than the screw, fill it with Smooth-On and insert the screw. The screw will be as rigidly fixed as the wall.

Hundreds of uses of Smooth-On are equally practical in home and automobile repairs.

Write for free repair book which shows you how to make many useful repairs, that will save you both time and money.

Write for FREE BOOK

Get Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can at your hardware store, or if you want us to send a 7-oz. sample can, enclose 35 cts. in stamps when you return the coupon.

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Dept. 58, 574 Communipaw Ave.
JERSEY CITY, N. J.

Do it with **SMOOTH-ON**

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574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....

Address.....

.....

Return this coupon for a FREE copy of Booklet

The Home Workshop

ARCHERY—The Latest Sport

(*Continued from page 85*)

wiping sticks. These staves were all of selected, split hickory, and when fashioned into a bow were worth a good saddle horse.

The value of a good Comanche bow was five horses; of a squaw, two horses. You can draw your own conclusions as to which the Comanche valued most.

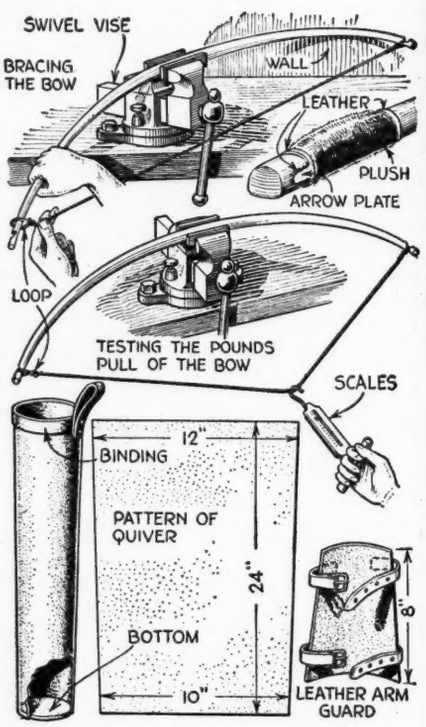
I do not mean a war pony—just an ordinary range pony such as the Comanches stole from the Mexicans on their raiding trips to the South. A spotted war pony was equal in value to from five to ten ordinary ponies and, by the way, old Carter had to pay his father-in-law, a Comanche chief, two fine war ponies and a rifle for his wife. The old Comanche thought a heap of his daughter, you see, and by the same token, so did Carter.

You who happen to have Indian-made bows, look them over carefully and if they are worth-while ones, wipe them occasionally with an oiled rag and give them as much care as their first owners did.

I have a few Indian-made bows in their cases of beaded buckskin that I treasure most highly, and some day I hope that I may teach my grandchildren to use these same bows, even as the grandfather of prehistoric man taught his grandchildren.

There are a few white men bow users today who can do all that, and more than, the Indian did with his bow.

Of bow woods, none is generally considered better than yew, though opinions differ; hickory is second best, and after them come osage orange (bois d'arc), lemonwood, mulberry, ash, ironwood, and witch hazel. Even willow, cedar and spruce have made good bows, though brash.



How to "brace" a bow for testing the arc, if no one is at hand to help you; how to find out or weigh the "pull"; suggestions for making a quiver and an arm guard

TO MAKE your own bow, get a straight, well seasoned billet of split wood, 5 or 6 ft. long and about 2 or 3 in. square. The long bow is usually as long as the height of its user, but I prefer one that reaches not quite up to my shoulder, as it is handier in the woods.

Mark the center of the bow stave, and from that point mark off the "hand" or handle 3 in. each side of the center. From the upper and lower marking, taper the bow (with drawknife or plane and spokeshave) gradually toward each end, the tip of which must be a little larger than one's middle finger. Then dress the "hand" or middle of the bow to a uniform diameter, about 1½ in.

Now try the spring or elasticity with a very strong, temporary string, for the bow must bend to a pull much greater than you ultimately will want. Next look for the flat of the wood grain, and there flatten the length of the bow one third its diameter, leaving the ends round.

To do all this, use a small block plane and finish with a very sharp spokeshave, laying the bow flat on the bench, floor or table when working it. Check up carefully by measuring both tapering sides to keep them equal throughout.

The round of the bow is called the "belly," and naturally curves or bends in; the flat part is called the "back," and is outside or away from the string. Sap or bark wood should be the back.

Horn tips are not imperative, but are the usual end of shop or trade bows, and make a good finish. Tips are usually made 3 in. long, of cow horn which has been soaked in warm water until the horn can be easily shaped and "nocked" with a jackknife and round file. A hole 1½ in. deep is bored in the butt end with a ⅜-in. twist drill (not a bit for wood). The hole is slightly enlarged at the opening, graduating to its end.

Shape bow at ends or tips so as to receive the horn tips snugly. Dip the tips in warm water, let dry partly, then paint the inside with strong glue, also the bow end; fit horn tip on carefully, its curve being toward flat or back of bow. Wipe off superfluous glue and set aside for several days. The notches or "nocks" for the bowstring should be carved on horn tips 2 in. from the end before they are glued to the bow.

The next step is to scrape the bow carefully with a cabinet scraper or a piece of broken glass and rub it with sandpaper, removing all irregularities and getting the bow reduced to equal curve or spring (nearly a true arc) and the desired "pounds pull." But, should (*Continued on page 87*)

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The Home Workshop

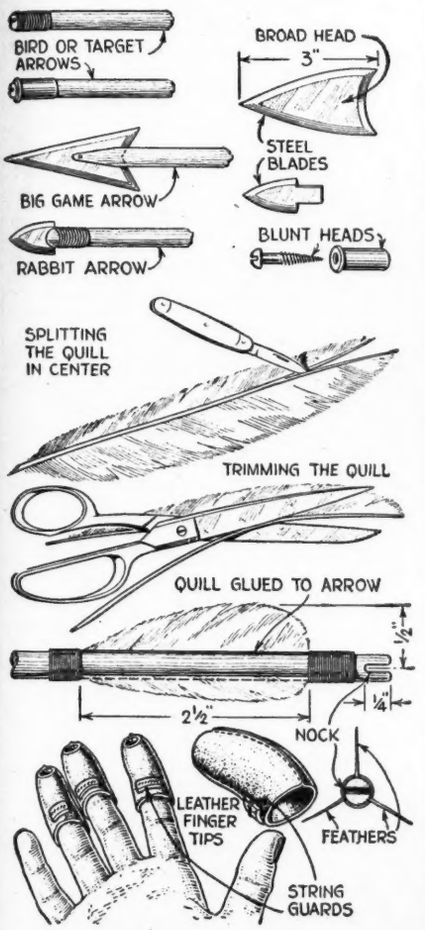
Archery—The Latest Sport

(*Continued from page 86*)

there be a bend in the grain of the wood, don't try to straighten it; it cannot be done without weakening the bow, and the only harm the bend does is to spoil the symmetry of the bow.

Now glue around the bow, at its middle or "hand," a piece of tan or brown velvet 6 in. long. The meeting sides should be on the back of the bow and the ends overlapped by strips of leather glued on.

Carefully oil the bow (protecting the velvet) with warm linseed oil, a little at a time. After two applications of oil, set



Various arrow points, how to trim and attach feathers; one type of leather finger tips

the bow away for a week, laying it flat on the floor to avoid warping. Then varnish or shellac in a warm room or in the sunshine. Let the varnish dry thoroughly and rub down to a dull, polished surface with rotten stone and oil. Keep the velvet well covered until the bow is finished.

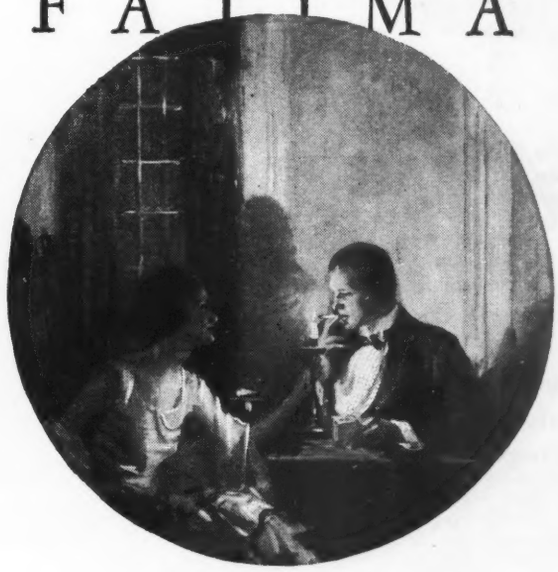
The "pull," "pounds pull" or "weight" of a bow is the number of pounds in pulling strength needed to pull the full-size arrow to its head. The English archer's bow was from sixty to eighty pounds pull; Indian bows, forty to sixty. Arthur Young's bow is eighty pounds.

The next step is to make a bowstring, though personally I prefer to use a heavy bass violin cord of catgut. But a fine bowstring can be (*Continued on page 89*)

"If...

FREQUENTLY you hear a man say, "If Fatimas were sold at fifteen cents everybody would smoke them." No doubt, but that's easier said than done. For without the finer tobaccos, the subtle delicacy, made possible by a few cents more, Fatima would not be Fatima

FATIMA



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LIGGETT & MYERS TOBACCO CO.

$100 in Cash Prizes See Page 4 in front of book for details

THE TEST

"I have examined a sample of "NOBURN" with a quartz spectroscope . . . I also experimented on the forearm exposed to intense radiations from the quartz mercury arc. No burns occurred when "NOBURN" was applied. Areas unprotected were very much reddened."
(Signed) M. LUCKIESH

Be Sunburn Proof

Dr. Luckiesh, Director Lighting Research Laboratories, Nat'l Lamp Works, General Electric Co., Nela Park, is famous for researches in light. His test confirms what thousands of sportsmen have known for years—that NOBURN gives absolute protection against sunburn. It prevents sunburn—but not the tan. Send $1 for bottle. Money back if not satisfied. Strong, Cobb & Co., 348 Central Avenue, Cleveland, Ohio.

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Your Dealer Can Supply You

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Pathé presents
Pathex
the perfected
motion picture camera

With F 3.5 Anastigmat lens!

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Made by the World's Pioneer in Motion Pictures!

The world famous producers of Pathe News now give YOU Pathex—perfectly designed, superbly built, reliable in operation, and priced amazingly low to assure *instant* popularity.

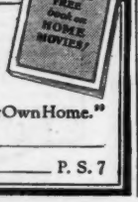
Outdoor time is Pathex time: This summer there'll be hundreds of subjects you ought to film—*in motion*. Get a Pathex Camera NOW! You can rely on Pathex: It's made by Pathe. *Every Pathex film you take will be developed FREE at the celebrated Pathe Laboratories!*

See famous screen stars in your own home!

Astonish your friends; entertain with the film classics of "Doug" Fairbanks, Harold Lloyd, Bessie Love, Leo Maloney, Micky, Farina, Will Rogers; see Bobby Jones in action! Films for every taste and every occasion in the Pathex Film Library—a wide variety at only $1.00 and $1.75 each!

Pathex home motion picture Cameras and Projectors are sold everywhere on easy budget payments. Should you not find Pathex at your leading store, write us immediately.

Note to Dealers: Users everywhere are delighted with Pathex. Territories still open in some parts of the country. Tremendous opportunity for you: Write today for Pathex proposition!



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Name _____

Address _____ P. S. 7

The Home Workshop

Overhauling *Our* Motor Boat

(*Continued from page 83*)

Now, let us go over the secondary mechanical equipment. Check up rudder cables, the steering gear and the pulleys, and remember upon assembly that everything which moves or rubs should be lubricated. If a part is hard to get at, oil well and smear with graphite grease.

Examine carefully the rudder and rudder shaft for corrosion. Just because both are of bronze means little, as severe electrolytic action can occur between two varieties of bronze.

TAKE off your propeller and lay it on a flat surface. Then, make a templet of the space between one blade and the surface and check each blade with this for pitch. If bent, straighten cold.

If the shaft is cut in the bearings, replace it. If there is quite a length of shaft in the boat, it can be moved aft and two couplings used inside, with a length of shaft put in to make up for the movement. Of course, the portion of shaft moved back will have to be cut off and the shaft re-machined for the propeller.

At this time the bearings in the strut should be examined and renewed if worn. Do not fit the shaft too tightly in this bearing, as there must be about .002 in. space for a film of lubricant. I have often thought that a graphite inlay for the bearing at this point would be a good thing.

Return the propeller shaft to its position, replace the packing in the shaft log, and put in plenty of graphite. If the shaft log is a long tube with an inside bearing and a stuffing box, load the tube up with grease; if it is of the inside stuffing box type, drill and tap the bearing back of the stuffing box for a pressure fitting and then put a tube and "gun" on it for a grease cup, and give the handle a twist every day. Every bearing must be lubricated, and if this isn't done with oil or grease, it will be done by water seepage in the form of a "leak."

Examine your mooring deck cleat and towing cleat fastenings. If these merely bolt to a deck frame, they can be made a lot safer by running steel or bronze straps from the bolts to the keel or hull frames as ties.

Go over the fuel lines, water lines, and electric wiring, and replace as necessary. Look over the exhaust pipe thoroughly. Many mysterious leaks originate in leaky exhaust pipes.

Give the inside of the hull a second coat of paint and put back the parts as taken out, but in reverse order. Do not, however, couple up the propeller shaft, as hulls out of water are always distorted. Engines should be "lined up" with the hull in the water.

AFTER the engine is in—(by the way, if you have pressure fuel feed, you might replace it with one of the little electric feeders now available)—we can finish up our external paint job. The value of our fall cleaning-up and priming coat is now apparent, as instead of a disagreeable scraping and burning job, we have now but to sandpaper off the job and put on our finishing coats of paint.

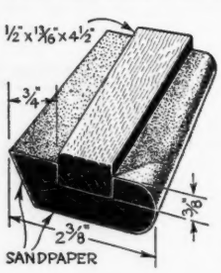
Now that the boat is painted, finish the details. These seem easier after launching, but *are not*. Put the boat in the water, and, after she has "soaked up," carefully aline the propeller shaft coupling.

This seems like a lot of work, but is really simple and will save much trouble during the boating season.

Sandpaper Block for Delicate Work

FOR sandpapering delicate work, small moldings, and the more intricate parts of. homemade furniture, the amateur woodworker will find that a sandpaper block of the type shown is useful.

A block of this size is intended for use with a quarter sheet of 9 by 11 in. sandpaper. If the make of sandpaper you use is smaller, the dimensions may have to be scaled down a trifle, as the quarter sheet must lap around far enough so that the central block will hold the ends securely when it is pressed into place. The rounded edge is useful for smoothing shaped pieces; the angular edge for getting into close corners.—R. S.



Ways to Build a Good Float

(*Continued from page 81*)

8 in. carriage bolts; four ⅜ by 5 in. carriage bolts; sixteen ⅜ in. round rods cut to suit and threaded at both ends, with nuts and washers; about 800 twenty-penny galvanized nails for flooring; four ⅝ in. eyebolts; tar for barrels, and paint for woodwork.

For the framework of a larger float: 4 pieces 2 by 3 in. by 14 ft.; 8 pieces 2 by 4 in. by 8 ft.; 14 pieces 2 by 4 in. by 14 ft.; 18 pieces 2 by 6 in. by 14 ft.; 6 pieces 2 by 8 in. by 14 ft.; 4 pieces 1 by 4 in. by 14 ft., and sufficient additional 2 by 6 planks to cut 16 pieces 40 in. long and 16 pieces 26 inches long.

Likes Our Blueprints

I COMPLETED the Pirate Ship model with the aid of your blueprints, and was really astonished. Your blueprints are wonderfully made and it is a pleasure to work with them.—O. M., Pullman, Wash.

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The Home Workshop

Archery—The Latest Sport

(*Continued from page 87*)

made of twisted linen or silk thread. A heavy carpet thread will do, twelve or sixteen strands of it twisted upon itself, then wet, stretched, dried and waxed with shoemaker's wax.

At the loop ends and at the center, whip the string with silk to prevent direct contact and wear. The "whipping" or wrapping to receive the arrow nock should be about 3 in. wide and only thick enough to prevent nock chafe.

Never keep a bow strung when not in use. Five inches from string to bow belly is enough space when the bow is strung.

A thick leather guard on the left wrist is almost imperative, as a swat from a bowstring is no "chicken's peck."

For arrows, select straight, well seasoned 5/16 or 3/8 in. dowels purchasable at a hardware store, lumber mill or joiner's shop. These are usually birch, although often called maple dowels. Cut to half the length of the bow. Make the nock 1/4 in. deep and about 1/8 in. or less wide, so that the cord fits snug, but not tight.

To feather the arrows, pull off the outer midrib of the broad side of a turkey or goose feather with the feathered part or plume adhering. Glue three strips of feather equally distant apart around the arrow, one feather being placed exactly at right angles to the nock. With fine thread temporarily wrapped around the midrib, keep all in place while the glue sets. When the glue is dry, wrap with silk thread the midrib ends. The ends of the thread must be tucked under the wrapping—no knots.

PAINT colored rings or bands around the arrow in front of the feathers as an identification mark. Every Indian did this, and the first mortal wound shot in game was the point of ownership to the animal, or its best parts. The entire arrow should be carefully varnished or shellacked and rubbed down with oil and rotten stone.

Empty 32, 38 and 41 cartridge shells fitted to an arrow make excellent heads for target shooting. Other arrow points are illustrated.

If you make your own arrow shafts, use split hickory. Place in a straight, grooved board and with a sharp, small block plane, work the strip down to 3/8 in. in diameter, perfectly round, as gaged through a ring or hole (as in a steel dowel plate) of that size. Coarse and fine sandpaper will give it the final finish, ready for feathers and nocking.

If one thinks a bow and arrow is a child's toy, read the exploits of Saxton Pope and Arthur Young with their self-made bows and arrows. Turkey, deer, elk, moose, bear and even lions were killed by their weapons and skill.

So, after all, there are a few today who still cling to man's prehistoric weapon, the origin of which is clouded in legend and conjecture; and these few are as skilful as those archers who won the battles of Hastings, Crécy, and Agincourt, and those who shot arrows through buffaloes.

in the hang and balance

Carpenters, who *KNOW* good tools, show their preference for Simonds saws by using them in their daily work. Simonds Saws reflect quality born of nearly a century of experience in making the finest steel cutting edges. *Ask any hardware dealer.*

Simonds Hard Edge non-breaking Hack Saw Blades—best for general use

SIMONDS HARD EDGE SIMONDS HACK SAW BLADES

SIMONDS SAW AND STEEL CO.
"The Saw Makers" Fitchburg, Massachusetts Established 1832
Branch Stores and Service Shops in Principal Cities

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SAWS FILES KNIVES STEEL

A new Parks! Cabinet Shop Special

No. 10

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THE MOST POPULAR MACHINE PARKS EVER BUILT! A winner from the start. A real machine, yet convenient size for the small shop. Does everything in woodworking. Has circular rip and cut-off saw, 6-inch jointer, 16-inch bandsaw. Lathe and shaper attached if desired at small cost. Operates from any light socket. Just plug in and go to work!

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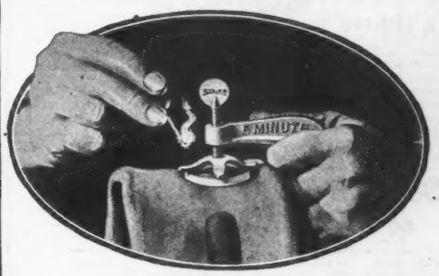
PARKS
WOODWORKING MACHINES



to make repairs last
VULCANIZE with HEAT

Any tire repair man will tell you that to make puncture repairs last you must VULCANIZE with HEAT. That's why more than four million motorists use the Shaler 5-Minute Vulcanizer. It's the quickest and easiest way to fix punctures, and makes repairs permanent under conditions that would soon loosen any cemented patch.

Complete Outfit
Costs only $1.50

At auto supply dealers everywhere. Slightly higher in Canada and far West. Includes Vulcanizer and 12 Patch-&-Heat Units—ready to use.

C. A. SHALER CO., Waupun, Wis.

SHALER

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ACTION brought to your feet!

8 Power Prisms — Send NO Money — 10 Days' Trial FREE

POWERFUL BINOCULARS

FOLLOW autos roaring 'round the track! Horses tearing down the turf! Flight of fowl high in sky! Observe movements of deer, bear, birds, ships, people—off in distance! Make your eyes **8 times stronger.** Keep a pair in your car! Motoring will become a joy! When off for a hike—sling them over your shoulder—(*they add that smart military air*)—and enjoy beautiful vistas—as never before. These Binoculars will prove a never-ending lifetime joy. *Indispensable for camping, hunting, hiking, yachting, races, motoring, shut-ins, observation, bird and nature study, etc.*

Hundreds Supplied to Army and Navy Officers

A LIMITED importation received! French and German Army Officers' **8-Power** Prism Binoculars, famous PREMIERE QUALITE, brand new, *perfect.* Brilliant illumination, exquisite definition; remarkable light gathering power. Wide field of vision—many times area of field glasses. Central focusing with individual eye-strength and width adjustments. Superbly constructed, handsomely finished in rich grain leather. Heat and moisture proof. Usually sell for $40.00 to $50.00. Our price (*while limited importation lasts*) complete with leather case, neck and shoulder straps **$23.50**

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(*We have confidence in our goods.*) If pleased with BINOCULARS you may pay on Budget Plan:

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Gentlemen:—Send me **8-Power Binoculars** $23.50 for 10 Days' FREE Trial. If pleased, within 10 days I have the privilege of paying $5.00 monthly or of deducting $1.75 and sending **$21.75** in full settlement. Otherwise, I shall return them.

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Pop. S. 7-26

Wash Your Car Easily, Quickly with Wash-Rite Auto Mop

Just attach to hose. Water flows through mop, flushing dirt away instantly. Cannot wet upholstery or injure paint. No more stooping, dipping, wringing. Saves time, money, clothes—and its fun! At your dealer's or send $1.50 and Wash-Rite will be sent postpaid. **Wash-Rite Auto Mop Co., Dept. 14-S., St. Louis, Mo.**

Jobbers, Dealers and Salesmen: Send for proposition.

The Home Workshop

We Build a *Woodcraft* Cabin

(*Continued from page 72*)

each end. The 20-ft. ridge-pole was carried on short posts resting on the end stringers. A 20-ft. purlin on each side divided the space between ridge and side stringer.

On this roof framework we nailed 8-ft. slabs, *round side up*, letting them project a foot for eaves. Over these we went with axe and hatchet, cutting off bumps or knots that might injure the paper.

Then we tacked on the roof paper, carefully pressing it down in the dips between the round sides of the slabs. Tar was applied plentifully, not only on ridges and over joints, but in large erratic patches and streaks. A pot of white paint was thinned with oil and splashed over the roof with a broom. Then, while tar and paint were wet, I pelted the whole surface with sand, clay, and moss. This stuck on the soft paint and tar, and wholly cleared away the horrible shop-made look of the roof.

For walls I had decided on slabs, with the bark on, because they were at hand. Woodcraft is "What you have, where you are, right now." Under some circumstances I might have used logs, but they would have greatly increased the labor.

WE discussed the advisability of using oak pegs instead of nails to fasten on the slabs, so as to make it a wholly wildwood cabin. But this would have entailed making a hole for each peg, and considerably added to the work.

When it came to the door, I made that of slabs, duly slatted together, and added an angle brace. Woodcraft hinges were decided on.

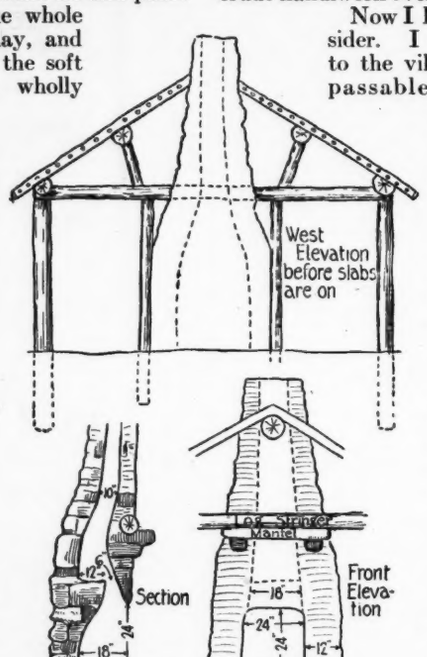
About this time a local carpenter, out of a job, came around to ask if we needed help. On being told, "No," he sat down on a near log to smoke and express his utter contempt for our crude, quick, and handy woodwork. His scorn mounted ever higher as I set about the wooden hinges. He wondered why I did not go to the hardware store and get a real good pair for a quarter.

But I went calmly on. I cut a young hickory slat for the top, and bored an up-and-down hole through this. Then I whittled a strong hickory fork so it was a right angle, with one leg 3 in. long and the other 1 ft. An auger hole in the post received the long leg. The other went through the long wooden strap which, when nailed on the door, made the upper hinge.

The lower was a hickory slat nailed as shown, with a projecting pin, 1 in. thick, which was received in a hole bored in the log doorsill.

As I drove in the last nail that fixed this and gave the door its trial swing outward, the Carolina carpenter spat out his quid, as he ejaculated: "Hell, it works!"—then he walked off to bother us no more. In that simple exclamation, I found ample offset to the scorn of the whole day. It was his acknowledgment of my victory—rather, the victory of our crude handiwork over the hardware store!

Now I had the latch to consider. I could have gone to the village store and got a passable thumb latch for twenty-five cents, which would have worked so far as latching the door was concerned. But I wanted it woodsy, quaint, homemade. And also I wished to enlist the magic of the old phrase, "the latch-string is out for you."



The framework at the fireplace end, and views showing details of the fireplace construction

SO, of hickory I made an inside bar with a keeper, and in the door jamb placed a hook. Then, through a nail hole, enlarged by using a red-hot nail, I pushed a leather thong, fastened one end to the crossbar, so it would lift when pulled, and the old pioneer latch was complete. By drawing the string in at night, the locking of the door was effected. By leaving it out, it was made plain that we were "receiving."

The windows were nothing but square openings. But we made slab shutters, which hung by canvas strips from the top outside, and could be closed with a button at the bottom.

For the floor we merely leveled, watered, and hammered the clay.

We finished up our cabin by making eight bunks of hickory rods, four up and four down.

This took us a little more than three days. But no cabin is complete and really a happy spot without a fireplace. Stone was abundant, sand was cheap, and cement available at a dollar a bag.

We borrowed a couple of trowels, and in one day more (*Continued on page 91*)

IS This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS See page 6.

The Home Workshop

Rope Sling Aids in Climbing Tall Radio Mast

WHEN the rigging on your radio mast or flag pole breaks and repairs are needed at the top of the pole, the only solution often is to climb the pole or take it down.

Not everyone is an accomplished pole climber, and even if you can climb, it is rather difficult to do any effective work

Fastening an aerial wire at top of pole

at the top, such as unfouling the tackle or running a line through the block.

By using a short rope sling, as shown in the accompanying illustration, the task of climbing the pole and working at the top is made much easier. The sling is wrapped around the pole and one end passed through the bight and drawn up.

When ready to start the climb, pass one leg through the free bight and climb in the usual way. The sling will move along as you progress. A rest may be taken at any time and the weight of the body brought to bear on the sling, which will tighten up and grip the pole.—H.W.

We Build a Woodcraft Cabin

(*Continued from page 90*)

made a tiny but satisfactory open fireplace at the end opposite the door.

Now our cabin was truly finished, and we celebrated with that thrilling, consecrating ceremony called the "lighting of first fire."

That night we slept in the bunks. It was cold, but the place was steeped in the sweet, holy odors of the forest. We felt the joy of complete success. And as we sat late about the blazing, crackling fire, we experienced some of the best feelings that belong to the far past epochs—feelings which rarely enter the lives of those whose notion of home is a polished, rug-strewn floor, and whose joy and comfort are symbolized in a steam radiator.

The cabin is there yet, unharmed by the storms of six years. The tents near-by have rotted away.

But the Woodcraft Cabin stands today not only in the Blue Ridge, near the great assembly hall and camp, but in a hundred other parts of the country. For every year it is seen by thousands. Those who are ready for it get the message, and carry plans and ideas away to realize them in their own camps, in every remotest part of the land.

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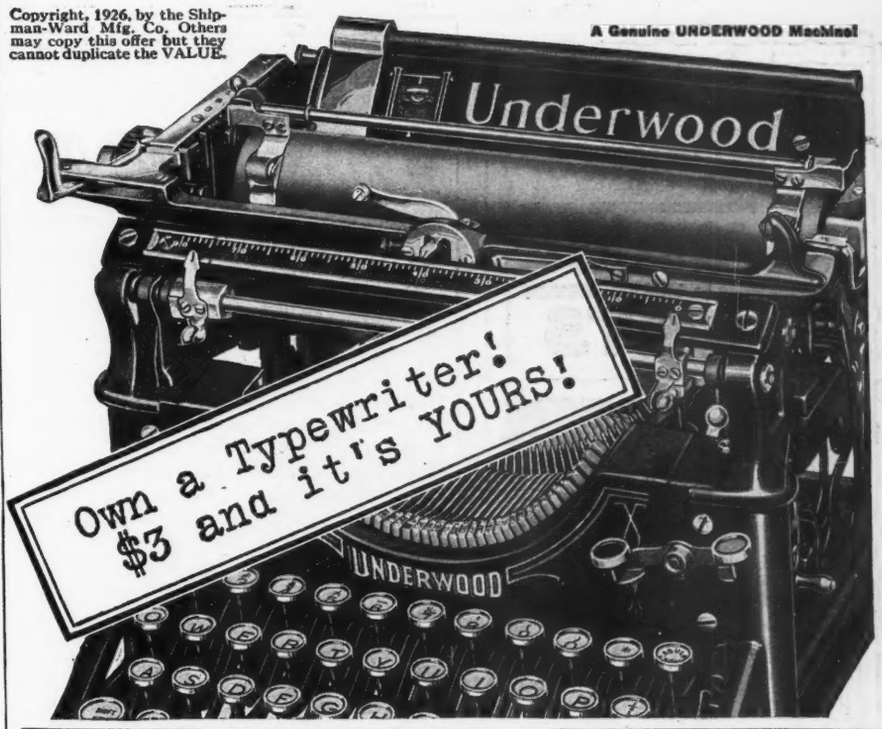
A Genuine UNDERWOOD Machine!



A Bargain You Can't Ignore!

A Standard Typewriter Is a Joy to Every Member of a Family!

GET YOUR typewriter *now*. A genuine, Shipman-Ward rebuilt Underwood—"the machine you will eventually buy." Don't send a cent, but do get our special offer—valuable book on typewriting—*free*. You can learn to write on this standard-keyboard Underwood in a day. In a week, you'll feel lost without it! The free trial will *prove* it. Our rebuilt plan gives you the *best* machine and a *big* saving.

Act NOW If Ever!

Speak up, if you want one! This Underwood is so popular this lot we're completing now won't be long in selling! Rebuilt from top to bottom—*every single worn part replaced*. New typewriters are guaranteed for a year; we guarantee this one *five* years! That's our Better-Than-New Guarantee. And we guarantee a big saving!

We don't want a penny now. Nor any money at all, unless this proves the typewriter bargain of your life. The trial is *free*. If you buy, our easy terms make it a pleasure to pay. There's no excuse now, for not owning a typewriter—and the finest make! We include all tools, cover, etc., all complete, all ready to write. Write us now. Deal direct; we are the largest factory of the kind.

FREE! Get our catalog free; lowest prices and terms. A manual free, too; valuable instruction for learning rapid typing, useful pointers for all who use a typewriter, business forms, social correspondence, work for others, etc. Clip coupon *now!*

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Please send FREE, full offer, catalog, typing manual, and outline your free course in Touch Typewriting, without obligation!

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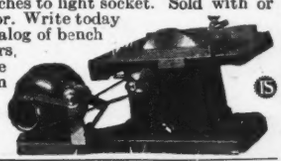
It's Easy to Build Things
—when your ripping, mitering, grooving, etc. are done on the
Boice-Crane Handisaw

Made in three sizes. Swings saws as large as 8" to cut 2½" stock. Attachments for grinding, dadoing, sanding. Driven by any ¼ to ½ h.p. motor. Attaches to light socket. Sold with or without motor. Write today for descriptive catalog of bench saws, drills, jointers, band saws, and the Boice E-Z Pay Plan



W.B. & J.E. Boice
Dept. P.S. 7-B
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MOTORCYCLES

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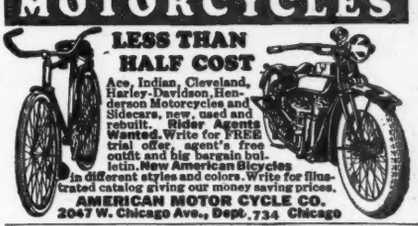

Ace, Indian, Cleveland, Harley-Davidson, Henderson Motorcycles and Sidecars, new, used and rebuilt. **Rider Agents Wanted.** Write for FREE trial offer, agent's free outfit and big bargain bulletin. **New American Bicycles** in different styles and colors. Write for illustrated catalog giving our money saving prices.
AMERICAN MOTOR CYCLE CO.
2047 W. Chicago Ave., Dept. 734 Chicago

What Could You Do with $50?
See the Cash Prize Offer on Page 4.

FOR CLEAR, QUIET "B" POWER

2.75 RADIO
Storage "B" Battery

12 Cells 24 Volts *Lasts Indefinitely—Pays for Itself*

Economy and performance unheard of before. Recharged at a negligible cost. Delivers unfailing power that is clear, pure and quiet. Approved as 1 listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with *Solid Rubber Case*, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. **Extra offer:** 4 batteries in series (96 volts), $10.50 Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. $11.25; 120 Amp. $13.25; 140 Amp. $14.50. All equipped with Solid Rubber Case.

World STORAGE BATTERIES

Set your Radio Dials at 219 meters for the new 1000 watt World Storage Battery Station, WSBC, Chicago. Watch for announcements.

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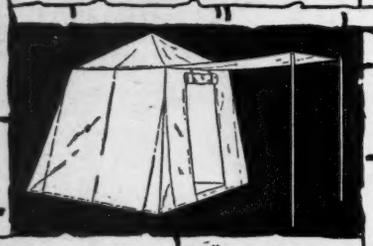
For Convenience
AMATCO TENTS



AMATCO HOME-CAMP. No center pole. Maximum head room. Four steel corner poles collapsible to 2½ feet. Always rigid, erect, convenient and roomy. OLIVE SHOWER-PROOF fabric.

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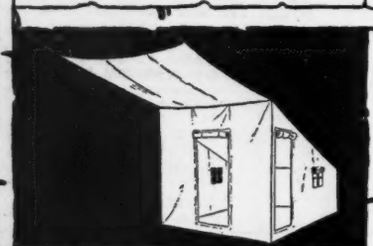

AMATCO BOSTON AUTO TOURING TENT. The De Luxe Auto Touring Tent. Convenient. Comfortable. Two roll-up doors. Two bobbinet windows for ventilation. For further details on these and other tents write for combination catalog—instruction book, HINTS FOR TOURISTS AND CAMPERS.

Every feature of convenience is built into AMATCO TENTS. Easy to put up or take down. The choice of the experienced camper or tourist. At your dealer's or sent direct to you; carrying charges prepaid.

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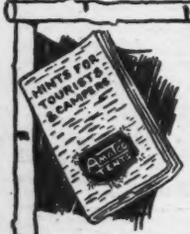


LET US SEND THIS VALUABLE BOOKLET "Hints for Tourists and Campers" by The Old Timer —combined with complete information on AMATCO TENTS and accessories. Every prospective auto tourist or camper should have this little booklet. Sent Absolutely Free. MAIL THIS COUPON TODAY.

Please send me above booklet by return mail.

.....

.....

The Home Workshop

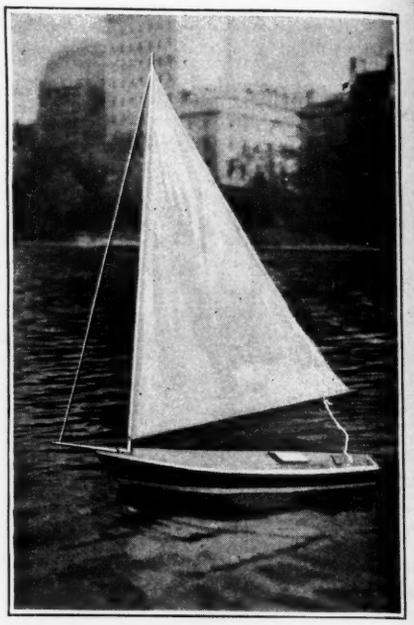
A Yacht Model *for* Racing

(*Continued from page 70*)

which is waterproof. It is a white powder, and should be mixed with cold water to the consistency of cream, at least half an hour before use. For exacting work like this, it should be used the day it is mixed. It is obtainable at model shops, from casein glue manufacturers, three-ply makers, and possibly elsewhere. Once it is set, water has no effect on it. If other glues are used, all joints must be shellacked or otherwise protected from damp; this applies particularly to the inside of the joints.

When the glue is dry, shape the hull with chisel, plane, spokeshave, knife or what you will, to the profiles shown in Figs. 3 and 6. Note that seven cross-sections of one half of the hull are shown. These represent the shape of the hull at the stern and at six other places indicated in Fig. 3 by the station lines I–VI. These lines are spaced 3 in. apart, the deck plan being 21 in. long over all. The bottom of the hull for about 11 in., where the keel is to come, must have a flat surface about ⅝ in. wide.

Cardboard templets may be made of the seven section lines, and the wood shaved away until they fit on. It is, however, more important that both sides are made alike in shape and thickness than that the lines are preserved exactly as given. Small deviations from the design will do no harm.



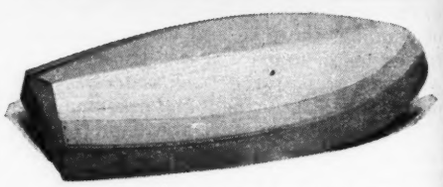


Fig. 4. The yacht on a trial spin in Central Park, New York. Fig. 5. Under view of hull

HAVING given the block a final shaving, scraping and sandpapering, scribe a line all around the outside 3/16 in. from the top. Cut in along this line to form a rabbet or recess 3/16 in. deep at the bow. This tapers to nothing amidships, as will be seen by studying the sections shown in Fig. 3.

Cut away the inside until the hull is about ¼ in. thick, if you feel equal to the task, but do not cut too fine at the top; leave ⅜ in. at the edges, and plenty of wood at the bow and stern.

It is hardly necessary to add that three pieces of ⅛ in. thick wood may be glued up for the block A, in which case proceed just as if one solid block had been used and do all of the cutting after the stock has been glued.

To make and fix stem E, use a piece of cedar or other semi-hardwood, ⅞ by 1 by 2 in. The shape of this is difficult to describe, but can be seen in Figs. 2 and 3. It fits on the fore end of block A. It is best fastened in place by boring a ¼-in. hole right through it into A and inserting and gluing a dowel. Dowel sticks may be obtained at any hardware store.

The stern board C, 3/16, ¼ or ⅜ by 1 by 4¼ in., should be of similar wood. It is glued and nailed from underneath, and a couple of nails are toe-nailed in from above, inside.

Two temporary molds D, as indicated in Fig. 7, of any wood, are lightly nailed in position from underneath through the hull. The large one is placed about 8 in. from the stern and the smaller, 6 in. from it, but before fixing them move them along until their edges coincide with the edges of the hull.

For the side planks B, use two pieces of straight-grained wood 3/16 by 2¼ by 22 in. These can be of soft pine, but cedar or mahogany, when varnished, makes a more attractive appearance.

(*Continued on page 93*)

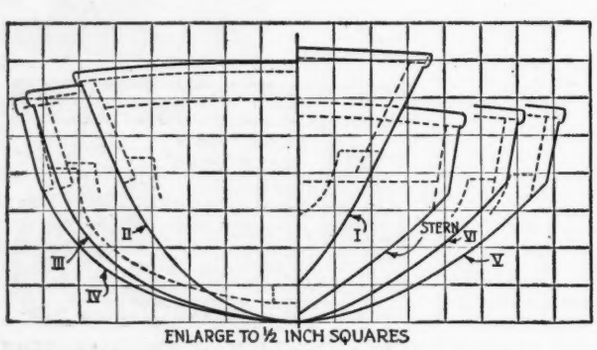


Fig. 6. To aid in shaping the hull correctly, it is well to make seven cardboard templets by enlarging these section lines

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The Home Workshop

A Racing Yacht Model

(Continued from page 92)

Make cardboard pieces first, stretch them along and see that they fit, getting them to come snugly together at the bow and leave a slight overlap at the stern. Do this on both sides. It will be noted that they lie in the rabbet at the fore end. Then cut out the wooden strips.

The fore end of these pieces will need steaming or boiling before being bent into shape. They can be put in a bucket of boiling water for twenty minutes, then bent rather more than the final shape and thus fixed until dry. Lay them in position and lightly nail to the molds, seeing that you have a very neat fit at the stem. Remove them, glue them, and clamp near the bow. Nail them to the stem and all the way along, working aft toward the stern board. Keep the nails well up from the edge and point them down into the hull. The thinnest obtainable ½-in. brads are best. Brass nails do not hold well. Use a small twist drill or fine brad-awl to make the necessary holes.

The deck beams F, Figs. 2 and 3,

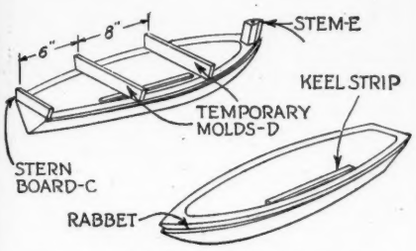

Fig. 7. After block A is shaped, the stern board, stem, keel strip and molds are added

which are cut from a strip ⅝ in. square in cross-section, now should be put in position. The short one is 4½ in. from the stem, and the longer, 6½ in. from the outside of the stern. Do not cut the ends until the pieces have been placed across the side planks and the edge bevels marked. Note that they rise in the center, 3/16 for the shorter one and ¼ in. for the longer one; this is called the camber and both makes the deck stronger and insures the water's running off.

Glue and nail the beams in position and remove the temporary molds. Plane the top edges of the side planks so that both sides are exactly alike in height and slightly chamfered toward the outside.

Bevel the lower edges of the side planks to the slope of the hull at the after end, and the hull to the edges of the planks at the forward end, so that the whole length is one smooth curve.

Along the bottom of the boat inside, glue a strip of wood about ⅝ by ½ in. in cross-section to take the screws that will hold the keel in position.

At this point, before inclosing the hull, give the inside a good soaking with warm linseed oil.

The boat is now ready for the deck, G. This had best be a piece of ⅛ in. thick three-ply wood 8 by 21 in., mahogany for preference. Lay it in position, mark it underneath,

(Continued on page 94)

Charge Indicator

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P-S-M-7-26

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The Home Workshop

We Add Another to Our Ship Model Blueprints

NOW that we have given those of our readers interested in making decorative ship models two sets of blueprints with which to work, we have prepared drawings to aid those who wish to build the type of ship model that will really sail.

These drawings are incorporated in Blueprint No. 48 in the list below. They show the full-size hull and the details of the 20-in. racing model illustrated at the right. Other views of this remarkably speedy model will be found on pages 70 and 92 in connection with Captain McCann's article, "A Yacht Model for Racing."

A Racing Yacht Model

(Continued from page 93)

and cut to shape. Glue a piece of the same or other thin wood about 2½ in. square on it, centered about 6 in. from the stern. Through this and the deck cut a hole about 1½ in. square for the hatch. Now glue and nail the deck to the side planks and ends.

A light molding along the top edge, H, called a sheer-mold, helps this joint, and if made of wood of a contrasting color adds to the appearance. It should be about 3/16 in. wide and 1/16 in. thick and go right around; glue and nail it lightly.

A HATCH cover, J, is needed to fit in and on the opening. It is made from two pieces of wood, or, better, a piece of wood for the top and a piece of cork to fit in the opening.

Only well seasoned wood should be used throughout. Such small pieces as are needed can often be found on the lumberyard or carpenter shop junk heap.

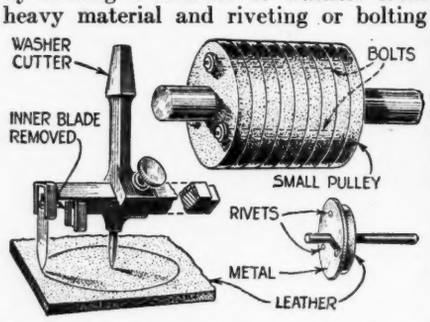
Most of the cutting and finishing operations described can be done most handily by holding the model between one's knees. The hull is frail until completed, and any kind of vise is likely to crush it.

Fill any cracks and nailhead holes with white lead tinted brown, if the top is to be finished in a natural color. Give the lower part, as far as the water line, two or three coats of light gray paint, and the upper, the same number of coats of clear spar varnish. Rub down between each, and stand by to make the spars, sail, keel, and steering gear next month.

Making Small Wheels Quickly

AN ADJUSTABLE washer cutter designed for use in a hand brace can be used for making wheels for toys. Solid disks are cut from sole leather or fiber such as is used for gaskets and washers around steam fittings. Flanged wheels to replace those on toy trains can be made by riveting a thinner and larger metal disk to each wheel.

Small pulleys for motors can be formed by cutting a number of washers from heavy material and riveting or bolting them together. If the holes to fit the shaft are cut to a driving fit and the washers driven into the shaft one by one, they will, when bolted together, grip the shaft very firmly.—REUBEN JENSEN.



A washer cutter serves for cutting the disks, which can be used singly or in combination

Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.
Popular Science Monthly
250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose.....cents:

No.	*Title*	*Published*	*Price*
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9.	Arbor, Gate and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
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44.	Pirate Ship Model—Hull	Feb., '26	25c
45.	Pirate Ship—Details	Mar., '26	25c
46.	Galleon Model—Hull	May, '26	25c
47.	Galleon Model—Details	May, '26	25c
48.	Sailing Yacht Model	July, '26	25c

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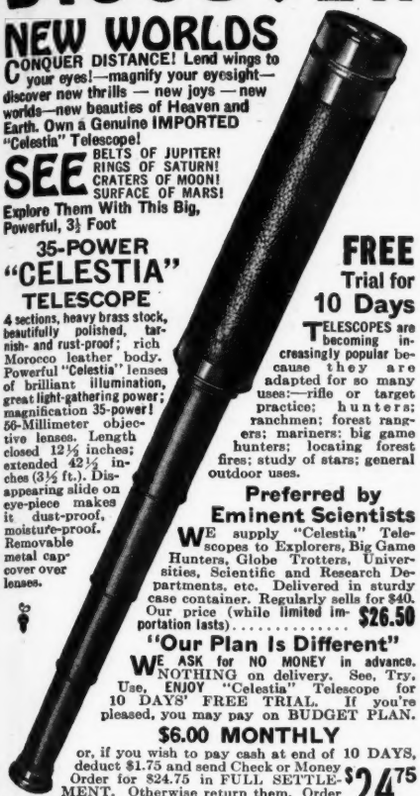

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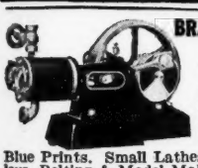

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What Could You Do With $50—?

See the Cash Prize Offer on Page 4

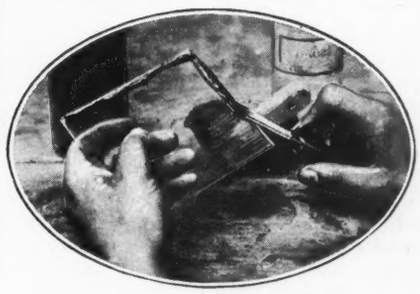
Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

WATER GLASS is one of the chemicals that should be on hand in every home workshop. It can be obtained at any drug store. It is used universally as a preservative for eggs, but to the worker with tools and chemicals its greatest value lies in its fireproofing and cementing capacity.

Water glass is a thick, viscous, syrupy water-white liquid. It should always be tightly stoppered with a cork. Never use a glass stopper, as it will become tightly cemented to the neck.

When water glass is mixed with lime or cement, a double silicate is formed that is resistant to all types of activity. Wooden workbenches brushed with dilute water glass and then with a solution of lime or



Applying a cement of water glass and precipitated chalk to the edges of a piece of glass

cement held in suspension in water, soon dry to a hard, almost stonelike surface. This will resist heat and the activity of almost all types of chemicals.

It also gives us one of the best types of cement for uniting porcelain and glass. The water glass should be mixed with precipitated chalk to form a very thick mass, which should be well stirred with a piece of wood as rapidly as possible. The entire mass becomes hard within thirty minutes. After it has been mixed, the cement is applied and the pieces are tightly pressed together and tied or clamped. The cement that exudes must be removed before it becomes hard.

For your convenience, the following label has been prepared. It is intended to be cut out and pasted on your bottle of water glass or filed among your formulas.

Water Glass

(*Sodium Silicate*) Na_2SiO_3

Keep tightly corked. Do not use glass stopper.

For fireproofing wood, brush on dilute solution of water glass in water and then coat with cement or lime suspended in water.

As a cement for mending glass and porcelain, mix water glass with precipitated chalk and apply quickly to the object. The cement will withstand the action of water, acid, alkali and alcohol. The cement may be colored black with antimony trisulphide, greenish black with iron dust, gray with zinc dust, dark green with chromoxide, blue with cobalt blue, orange with red lead, bright red with mercuric sulphide.

This is the first of a collection of handy reference labels to be published in the Home Workshop Chemistry column.

Running Ahead? or Just Running

Machines just run without thought of running *ahead.* But see their records on Veeder Counters, and you see the room for improvement!

You promptly see the improvement *register,* by closer watch of the operating.

You get new "leads" to improved design, from the check-up of your *production-gains* on

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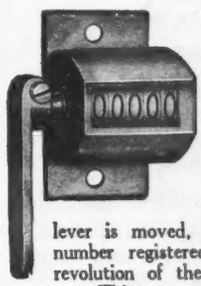
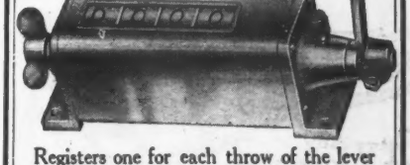
This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price $2.00. (*Cut nearly full size.*) Small *Revolution* Counter, also $2.00.



The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50 subject to discount. (Cut *less than ½ size.*) Set-back *Revolution* Counter of similar model, $10.00 (list).

Write us about that counting problem of yours—or see how it's solved in the big Veeder booklet; copy free.

The Veeder Mfg. Co.

44 Sargeant St. Hartford, Conn.

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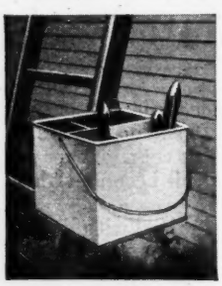
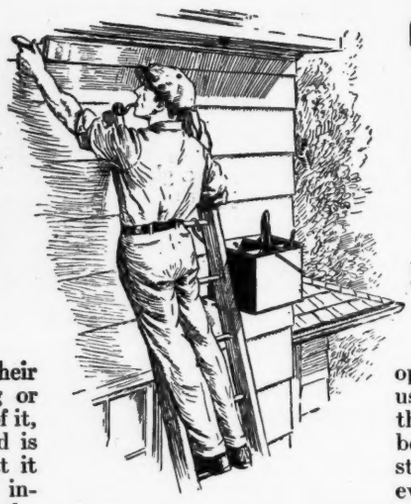
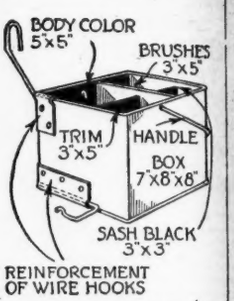


Colors and brushes are always at hand





The can is divided into four sections

FOR those who do their own house painting or even a limited amount of it, the paint kit illustrated is worth many times what it costs to make one, or, indeed, to have a kit made.

The pail is divided so that two or three colors may be applied without getting down from the ladder. It is much more convenient in every way than the old style of pail with a hook.

With a tin snips and soldering outfit it can be constructed with little difficulty in any home workshop.

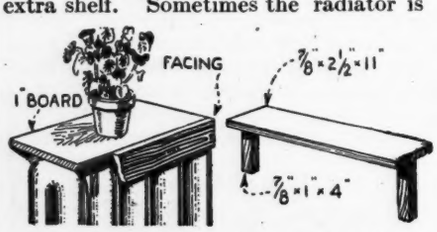
When the wires are bent to give the proper tension, the pail sets firmly against the side of the ladder, always ready for the brush. The bail does not interfere with the ladder rung. Incidentally, the brush is more easily dipped into a square opening than in the usual round pail, and the surplus paint may be wiped off against a straight side more evenly.

If placed on a flat surface, the pail is not apt to be tipped over; it will even stay on a moderately slanting roof.

The hanging wire is made of heavy wire, such as No. 10 gage, so that it will not bend while in use. There should be extra straps or reinforcing pieces riveted on the container where the wires are attached. In the pail shown, the upper hanging wire is a continuation of the wire that forms the upper rim. If desired, a tight fitting cover may be added, but the author in actual work found there was little use for a lid.—W. W. WHITE.

A Radiator Shelf

IN MOST homes nowadays, some use is usually made of the space occupied by certain radiators to supply an extra shelf. Sometimes the radiator is inclosed in an elaborate grill; often a simple board is placed on top.



Two saddles made as shown at the right support a board, which serves as the shelf

To get a board into stable equilibrium, especially if the top of the radiator is at all rounded, is not always easy. The accompanying illustration shows an effective method.

Two saddles are made with vertical legs just thick enough to fit snugly between the coils of the radiator and long enough to allow the cross strip to project slightly above the curved top of the radiator. Stout wood screws fasten the parts together.

The saddles are set astride the radiator two or three coils from each end, if the radiator is of average width, and the board for the shelf is rested on them. A facing piece may be used, if desired, to give a finish to the front of the shelf.—H. J.

Furniture Protectors

MANY PIECES of furniture have projecting handles, arms or corners, which usually get battered or sometimes broken in ordinary usage. These may be guarded by cutting simple protectors from old inner tubes which have been slit open, washed and flattened out. The actual covering protects the edges or corners in one direction; and the overhang protects them from the other direction.

The ones illustrated were used over the two outside arms of a tea wagon handle. They were held (*Continued on page 97*)

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21 JEWEL

Santa Fe Special

Guaranteed a Lifetime

No Money Down Sold on Credit

SEND FOR WATCH BOOK

We will send this famous watch, express prepaid, for you to examine, to inspect, to admire, to approve without one penny advance payment. Examine the watch and be convinced it's the best watch buy you ever saw. Just a small payment down, the balance in easy MONTHLY payments. You use the watch while paying for it.

Just Out!—New "Santa Fe" Watch Book

Send for our New Watch Book—just off the press. All the newest watch case designs in white or green gold, fancy shapes and thin models are shown. Read our easy payment offer. Wear the watch 30 days FREE. Nothing to risk. See the watch before you buy. Write for New Book Today—It's FREE. Select Your Watch NOW.

FREE A limited offer! With every Santa Fe Special, a beautiful gold chain or strand of exquisite pearls. Write today.

SANTA FE WATCH COMPANY
780 Thomas Bldg., Topeka, Kansas
(Home of the Great Santa Fe Railway)

Make Your Own 4th o' July Sparklers!

GET this fine SPARKLER OUTFIT. With it you can make 60 dandy big red and golden sparklers. It's lots of fun making your own, and they will be the best you ever had. Complete outfit containing everything needed to make 30 red sparklers and 30 golden sparklers; postpaid for **50c**

FREE! If you send at once, we will include a copy of the 4th of July Chemcraft Chemist Magazine telling about fireworks, and how they are made.

THE PORTER CHEMICAL CO.
116 Summit Avenue
Hagerstown, Md.

ZIP-ZIP

Here is a letter we received from a lady from way out west.

Gentlemen:
My boys were so delighted with the Zip-Zip shooters that they ordered from you that I am enclosing check for one dozen more. I want each of their friends to have one also. Please send these as soon as possible.

Thousands of boys are made happy with this wonderful Zip-Zip shooter. Order from us or your dealer. 35c each or 3 for $1.00. Send stamps, coin or money order.

AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

Print Your Own

Cards, stationery, labels, paper, circulars, tags, menus, book etc. Save money and time, cut cost in half. Sold direct from factory. Pays for itself in a short time. **Complete Outfits, $8.85 up.** Job Press, $12, $35; Rotary $150. **Print for Others Big Profits.** All easy, rules sent. Write for catalog of presses, type, paper, cards, envelopes, paper cutters. **The Press Co., E-33, Meriden, Conn**

Delivered to you Free

for 30 days trial on approval. Your choice of **44 Styles,** colors and sizes of the famous **Ranger** Bicycles. Express prepaid. Bicycles **$21.50** and up.

$5 a Month if desired. Many boys and girls easily make the bicycle earn the small monthly payments.

Tires wheels, lamps and equipment at half usual prices. Write for remarkable factory prices and marvelous offers.

Mead CYCLE COMPANY DEPT. F250 CHICAGO Write us today for free catalog

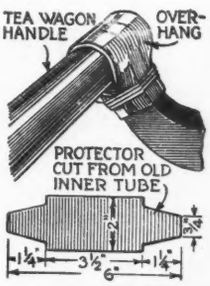
$100 IN CASH PRIZES

See Cash Prize Offer on Page 4 in front advertising section

The Shipshape Home

(Continued from page 96)

around the handle with a long, narrow rubber band. The tea wagon is of mahogany, and the dark red tube almost matches it in color; at least it is not offensively different, even on this very nice piece of furniture.



How the protector is cut out and applied

These protectors have found use on doll carriage handles, and on other toys, on extended arms of chairs, long pointed rockers, and in several other places around the home.—MORRIS A. HALL.

Painting Floors Easily

IT IS no joke to have to shellac, varnish, paint or lacquer the floor of a large room on your hands and knees. If a child's play car of one of the smaller varieties is at hand, it will be found to serve as a convenient seat for work of this kind.—J. D. G.

In painting a floor, tiresome kneeling may be avoided by sitting on a child's play car

Preparing Whitewash

IN KEEPING the cellar, shed and barn shipshape, and also in protecting trees against worms and insect pests, whitewash is as valuable as it is inexpensive.

For exterior use, such as on fences and sheds, dissolve 15 pounds of common salt in about 7½ gallons of water; add one 50-pound sack of hydrated lime, or the putty made by slaking ½ bushel of fresh quicklime in water; mix until a smooth paste is formed, and then thin with water as necessary.

When the whitewash is to be used for interior work, a paste made as before should have a solution of 3 pounds of glue in about 2 gallons of water added to it. The mixture should be stirred thoroughly and then thinned to the desired consistency. One quart of crude carbolic acid may be added to either of the mixtures as a disinfectant.

The surfaces should be cleaned and evenly dampened immediately before the whitewash is applied, to insure against chalkiness or flaking.

The

LYNCH METALLIZED RESISTOR

The old carbon lamp consumed *more* current to give less light. Tungsten, which is *metal*, proved more efficient, more dependable. Metal long has been recognized as the most efficient of electrical conductors. The Lynch Metallized Resistor gives non-arcing, *conductive* resistance. It marks as great an advance as did the tungsten lamp.

Arthur H. Lynch

PRICES:—

.25 to 10 Megohms	.50
above .01 to .24 "	.75
.001 to .01 "	$1.00
Single Mounting	.35

Warranted—
Absolutely Noiseless
Permanently Accurate
Dependable!

COMPRISING a concentrated metallized deposit one-thousandth of an inch thick upon a glass core and sealed within a glass tube, each LYNCH METALLIZED FIXED RESISTOR wins in the exacting tests of time and service. This *better-built* product has been endorsed by leading engineers and experimenters and the test laboratories of the leading magazines.

If your dealer cannot supply you, it will pay you to wait for the mail—we ship postpaid, and Lynch products are sold on a money-back guarantee.

Dealers—Write us!

ARTHUR H. LYNCH, Inc.
Manufacturers of Radio Devices
Fisk Bldg., Broadway & 57th Street
New York, N.Y.

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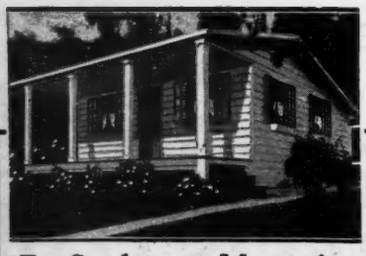


For Seashore or Mountains

"RADIO" Bungalow!

BY popular vote—the perfect summer bungalow! Now obtainable in a choice of 6 sizes, with from 3 to 5 rooms with porch.

Easily erected by unskilled help—two or three persons can put one up in 36 hours. Strongly constructed of best materials and lasts for years. Is fully portable, and can be removed to a new location whenever desired. Prepare for your happiest summer by ordering at once. Immediate shipment.

Write at once for free folder giving complete floor plans.

Send 20c for our new 48-page catalog showing beautiful homes built by Bossert.

Priced from

$472 to $826

F. O. B. BROOKLYN

"RADIO" Garage

Only

$295

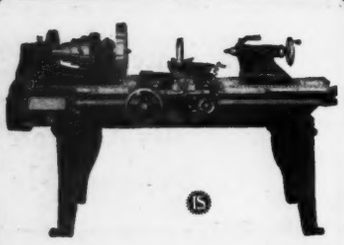
F. O. B. Brooklyn

Handsomely designed. Comes sectional-built; 12 ft. x 18 ft. inside measurements. Strongly constructed. An attractive addition to any home or estate. Can be erected by unskilled labor in 8 or 10 hours. Carried in stock for immediate shipment.

Louis Bossert & Sons, Inc.

"Largest Lumber Plant in the East"

1310 Grand St. (House Dept.), Brooklyn, N. Y.



16 inch x 8 foot Quick Change Gear Screw Cutting Lathe

New Lathe Catalog Free!

Shows 96 styles and sizes from the smallest Bench Lathe to the Largest Factory Production Lathe. Describes—

The New South Bend Lathe

a heavier, stronger Lathe of greater belt power—equal in accuracy and precision to any other Lathe made. The New South Bend Lathe sells at attractive prices—each one a remarkable value. Write for Free Catalog.

Easy Payments if Desired

South Bend Lathe Works

824 East Madison St., South Bend, Ind.

Better Shop Methods

Old Bill Says—

Old Bill, machine shop foreman

TOOLS are extra hands and fingers, even though we call them lathes, planers, squares, or calipers.

Every good mechanic is presumed to know the importance of accuracy.

A lot of us make the mistake of telling the boss how valuable we are without actually showing him.

A mechanic will seldom improve his craftsmanship when he has only himself for a model to copy.

You will have to pay for safety when you try to get along without it.

Think, and your work will be a thousand times easier, no matter what kind of job you have.

Aladdin's lamp can't hold a candle to your own brains, if you rub them once in a while.

There's no excuse for errors made in pure carelessness.

A few men like to take credit for all that is right about a job and blame someone else for all that is wrong. But they don't get very far.

Plenty of good oil in the right place helps to take the kinks out of production, but it never does any good on the floor.

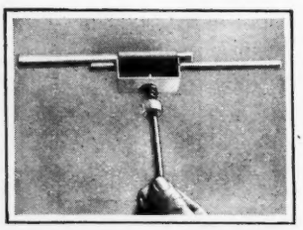
Always clean out the chip pan before machining copper or brass.

Keep the ways of lathes and planers clean and well oiled; frequent wiping with clean waste keeps the machine in the pink of condition.

A good workman generally has no difficulty in getting a good job.

Double Rod Holder Speeds Up Welding Work

TO SIMPLIFY the work of welding, it is possible to make a simple holder for gripping a thick and a thin piece of welding rod at the same time. Then, if the work requires a large amount of added metal at a certain stage, the larger rod can be used; and at another stage, when only a small amount of metal is required, the smaller rod can be presented to the work without an instant's delay.



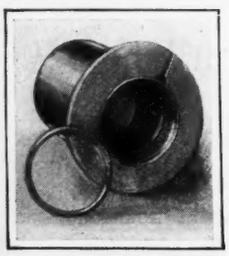
Light and heavy welding rods gripped in the one holder for making varied repairs

The holder, if made as shown, requires only a short piece of tube of a diameter to take both rods at one time. This is welded to a handle made from round stock. A sheet metal binding piece is cut V-shaped at the ends, drilled in the center, and bent so that it will pass over the handle and grip the rods when pressed against them by a short coil spring.

To load the holder, the binding piece is held back against the spring while rods are slipped in the tube. Anyone who has tried to manipulate two rods without a holder will appreciate this idea.—ARTHUR KENDALL.

Collet Jaw Adapter Eliminates Trouble from Chips

WHEN collet jaws of the split and draw-in type are used for holding work which is to have any form of hole bored or drilled, the chips often cause trouble by fouling the chuck.



The auxiliary bushing with work in place

On a great variety of pieces this difficulty may be avoided by the use of an auxiliary member—a sleeve, split on one side only, and with closed inner end. This will prevent the chips from entering the collet jaw at all, and thus cure the trouble.

The photograph shows a case in point. The bushing should have as thin walls as the work will permit, and be split on one side only. A pin in the face of the collet allows the bushing to be located so that the split does not come near any of the splits in the collet.

The enlarged flanged end of the bushing may be as large as the external end of the collet, to insure no chips getting inside the chuck. The closed end of the bushing makes of this member a bucket affair, which, when removed from the collet with the work therein, may be shaken free of all chips, and cleaned readily for receiving another piece for machining.

In this instance the auxiliary bushing is shown with the partly bored-out work still in place.—O. S. MARSHALL.

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AMPLION

Product of nearly 40 years' Experience

Upholding Amplion Supremacy

Hear the new Amplion Juniors. They have larger, more powerful units. The Amplion's world-wide supremacy in better radio reproduction is established even more firmly by this latest improvement at no increase in price. To hear your set at its best, hear it with an Amplion.

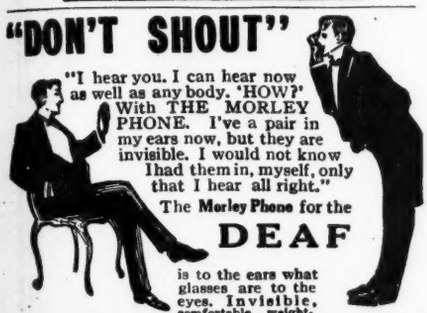
New Junior models with cords and plugs: AR-111, metal flare, $24. De Luxe, mahogany flare, $27.50.

AR-111 $24

THE AMPLION CORPORATION OF AMERICA

Suite M, 280 Madison Avenue, New York
Chicago Branch: 27-29 North Morgan St.
Amplion Corporation of Canada, Ltd., Toronto

"DON'T SHOUT"



"I hear you. I can hear now as well as any body. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the DEAF

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

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Sta. A, Dallas, Texas

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Protect Your Tools From Theft. Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil. Complete Outfit $3.50 Prepaid Anywhere. Interesting illustrated circular free. Write today. Agents wanted.

ARKOGRAF PEN CO.
1171-A East Stark St., Portland, Oregon

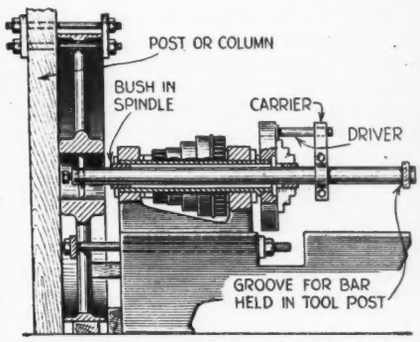
Better Shop Methods

Boring a Large Pulley on a Small Lathe

That Old Bill, with all his ingenuity, has rivals in far corners of the world, is evidenced by the following from a reader of POPULAR SCIENCE MONTHLY *living in Melbourne, Australia:*

I HAVE been interested in Old Bill's rigs as described in POPULAR SCIENCE MONTHLY, and I will describe a method I used to bore a large wheel with a 12-in. gap bed lathe.

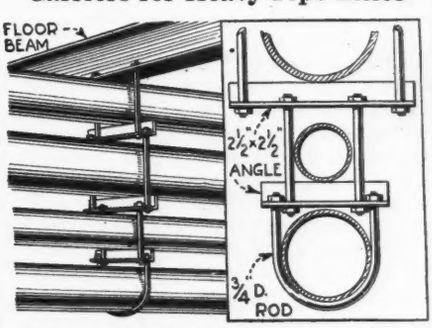
There was a "friendly" post at the end and to the rear of the lathe, which I used to support the wheel. I also clamped the spokes of the wheel to the bed of the lathe. The boring bar ran through bushings in the spindle, and was driven by a pin projecting from the chuck. Feed was obtained by having a groove in the boring bar to engage a bar held in the tool post.



The pulley was bored by passing a bar back through bushings in the headstock spindle

The tool was ground square-edged to avoid side pressure.—G. E. BURCHNALL.

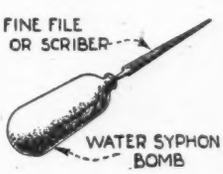
Carriers for Heavy Pipe Lines



ILLUSTRATED above is an efficient and economical method of hanging pipes from a floor beam. The pipes shown range from 6 to 10 in., and carry steam and water in the basement of a power house.—W. UHLMAN.

Unusual Tool Handles

WHEN I saw a machinist using a fine file with what looked to be a beautifully finished metal handle, such as I had never seen before, I asked him where he had got the handle. It was a discharged "bomb," like those used in soda water siphons.—S. W. B.



Better Flashlights

BURGESS flashlights and batteries provide a most economical service for night-time emergencies, when to be without safe, controlled light may mean serious accidents, delay and certainly much inconvenience.

You will find many sizes and designs in the Burgess selection. Handsome metal or fibre cases, short-circuit proof and dependable in all weather.

Burgess Flashlight Batteries fit all makes of flashlight cases and their service reflects the same craftsmanship and skill which has earned world-wide recognition for the Burgess Radio Batteries.

BURGESS BATTERY COMPANY
GENERAL SALES OFFICE: CHICAGO

Canadian Factories and Offices:
Niagara Falls and Winnipeg

BURGESS FLASHLIGHTS & BATTERIES

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140-page Book full of life-size ruled forms, each one completely filled in. The answer to problems of accounting and record keeping for any business or profession.

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MOORE'S LOOSE LEAF SYSTEMS
Used in 300,000 Offices
Ask about the New
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Big Catalog Free! Send for our big 132 Page Diamond Book; over 2000 bargains in Diamonds, Watches, Jewelry and Silverware. Absolutely FREE!
LOWEST PRICES ON FINEST, GENUINE
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CASH OR CREDIT
No. 25 $37.50 $1.00 a week
Special sale of large stock of genuine blue white Diamonds, all finest grade gems newly imported from Europe by us and sold direct to you. You have no middlemen's profits to pay—all the value is in the Diamond. Our reputation is your safeguard—we guarantee absolute satisfaction or money back.
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Wedding Rings
No. 824—The "Elite" $7.50
18-k white gold
Set with 3 Dia. $22.50; 5 Dia. $32.50; 7 Dia. $42.50; 9 Dia. $52.50; 12 Dia. $67.50
All Platinum, $25 up. With 3 Diamonds, $50; 5 Diamonds, $70; 7 Diamonds, $90; 9 Diamonds, $100; circled by Diamonds $200.
Wrist Watch No. 839—14-k white gold. High grade 15-Jewel movement. $25. $2.50 down and $1.00 a week.
19-Jewel Adjusted Waltham No. 846—14-k white gold filled; assorted patterns. $42.50. $4.25 down, $1.00 a week.
We carry all standard makes of Railroad Watches—guaranteed to pass inspection. Credit at Cash Prices.
LOFTIS BROS. & CO.
Stores in Leading Cities
Dept. B-871, 108 N. State St. Chicago, Illinois
The Old Reliable Original Credit Jewelers

SPORT BODIES for FORDS
at FACTORY PRICES!

This Model in Grey Prime $39.50

Write for Booklet A-10 Showing Other Models.

SPORT FACTORIES, Aurora, Illinois

SEE the big Prize Offer on page 4 of this issue

Better Shop Methods

How I Use Silver Solder in Doing Repair Work

By R. C. LEIBE

WHILE woodworkers are familiar with silver solder as a medium for joining band saws, its useful properties sometimes are overlooked by many mechanics. Silver solder is an alloy of about 70 percent silver and 30 copper, with sometimes other metals in small quantities. It is sold in thin strips ¾ in. wide. In the absence of the commercial product, it is possible to do satisfactory work with silver of a quality corresponding to that used in coins if it is beaten into a thin sheet.

Joints made with silver solder are very strong, hence its use for band saws. They will also stand considerable heat, for the melting point of silver solder is rather high. Once the trick is learned, joints can be made by anyone with almost no tools at all.

Figure 1 in the illustration shows the spring from a phonograph made almost as good as new with the aid of silver solder. The broken ends are beveled off as shown and carefully cleaned. A flux is applied, a strip of solder put between the prepared ends, and red-hot tongs clamped on the joint to melt the solder. The tongs are kept on until cold, when the joint is dressed to the thickness of the original spring.

The flux which the writer has found most successful throughout a lifetime of experience in brazing is borax with enough water to make a thin paste.

IN FIG. 2 is shown a crosscut saw repair. The ends of the break were filed to a feather edge with a lap of about ⅝ in., the laps were covered with the paste, a strip of silver solder was put on, then the laps were placed one over the other and red-hot iron bars applied. Clamps were used to insure the tightness of the joint. In this case, to retain the temper, water was applied after the solder had melted. When cold, the sides were filed off, and the saw was in good shape for more hard usage.

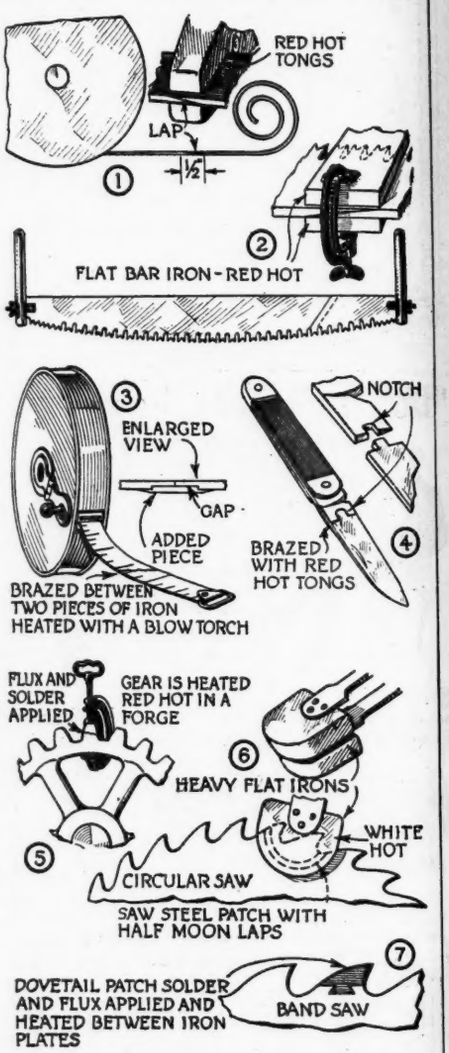
Figure 3 shows one of the most difficult jobs encountered. It was necessary to maintain the length of the measuring tape, and everything had to be done carefully. The enlarged view shows clearly the lapped joint and the added piece. In this case the joint was clamped tightly together while cold, and then clamps and tape were heated with a blowtorch.

In Fig. 4 is shown the method of repairing an expensive gold knife valued as a gift. A tiny strip of silver solder was placed between the tongue and the groove, and the blade heated in the one spot with red-hot tongs.

A METHOD of repairing broken gears is shown in Fig. 5. The braze is prepared while the gear is cold, then the whole thing heated in a forge. This type of repair can be carried out even in the country, where few tools are at hand.

Figure 6 shows the use of special tongs in order to replace a section in a large and expensive circular saw. The new saw steel patch was put on in just about the same way as has been described. At Fig. 7 is shown the style of repair chosen for a band saw which had lost a tooth.

Numerous other examples could be shown, but the principle in all of them is



Method of repairing crosscut, circular, and band saws, springs, tapes, knives and gears

the same. An important item is to have the thickness of the solder film uniform. The mechanic with a little ingenuity and some forethought will have no difficulty in repairing with silver solder many things that would otherwise have to be replaced.

TESTS FOR HARDNESS of steel parts made with common files are unreliable in cases where uniformity in duplication is required. Files themselves are apt to vary in hardness and quality like other steel pieces. That a metal cutting tool such as a drill, milling cutter, reamer or tap can be filed is far from an infallible indication of cutting qualities or durability.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, **emits rays of white light, rendering it perfectly visible** in the dark. **THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES.** Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons of switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several small articles, **Price 25c. Larger sizes 50c and $1** postpaid. **Johnson Smith & Co., Dept. 557 Racine, Wis.**

Microphone Transmitter Button

$1.00 POST-PAID

You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in micro-phones. You can mount the button almost anywhere—card board boxes, stove pipes, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Buttons may be used to receive telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. $5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE $1.00 POSTPAID ANYWHERE.**

JOHNSON SMITH & CO., Dept. 557 Racine, Wis.

U. S. BABY TANK

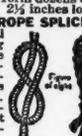
25 Cents

It goes with real Yankee Pep—by its own power

Most remarkable Toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down, it will crawl along, overcoming all obstacles, in the same lifelike manner as the larger Tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts; it will go backward or forward at will. 2½ inches long. **Price only 25 cents prepaid.**

NEW BOOK ON ROPE SPLICING

A most practical handbook giving complete and simple directions for making all the most useful knots, hitches rigging splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. **Price 20c prepaid.**



INVISIBLE INK

The most confidential messages can be written with this ink, for the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. **Only 15c Bottle**

MIDGET BIBLE

GREAT CURIOSITY

Smallest Bible in the world. Size of a postage stamp. **200 Pages.** Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE **15c** each, **3** for **40c, 12** for **$1.35, 100** for **$7.50.** Also obtainable in Leather Binding, with gold edges. **Price 50c each, 3 for $1.25, $4.50 per doz. Magnifying Glass** for use with Midget Bible. **15c.**

Every Boy His Own Toy Maker

Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages, 150 illustrations. **PRICE, 10c postpaid; 3 for 25c.**

Surprise Matches

More fun than fighting with your wife. Look just like ordinary matches. Put up in boxes just like regular Safety Matches. As the victim tries to light one he gets quite a surprise. **10c**

Price 10c per box, 3 boxes for 25c postpaid, 12 for 75 cents.

MAGICIAN'S OUTFIT

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment

EASY—ANYONE CAN DO THEM

75c

It is great fun mystify ing your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for seven firstrate tricks, including The Disappearing Rose, that, when placed on the lapel of your coat, vanishes from sight at will; the Magic Vase and Ball Trick (a Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket); The Magic Nail with which you can apparently cut your finger almost in two; the Wonderful Card Trick (a card is placed in an envelope, and when open an entirely different card altogether is found); The Disappearing Coin Box a coin is placed in the little wooden barrel, and, when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination); The Famous Dissolving Penny Trick; The Glass Goblet and Vanishing Coin Trick (a coin is dropped into a glass of water, and when the water is poured out the coin has vanished). With the tricks described above we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence, with this Cabinet of Tricks in his possession, can give a parlor entertainment not inferior to some regular magicians. Besides the tricks contained in the Cabinet, there are many other feats and illusions fully explained with full printed instructions, for which you easily make or procure the necessary apparatus. This **unexcelled** Cabinet of Tricks for **ONLY 75 CENTS POSTPAID TO ANY ADDRESS.**

A DeLuxe Edition of our new 1925 CATALOG mailed on receipt of 25c. Handsome cloth binding. Only book of its kind. 450 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, interesting books, curiosities in seeds and plants, etc., unprocurable elsewhere.

STAGE MONEY

With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. **Prices, postpaids 40 Bills 20c, 125 for 50c, or $3.50 thousand postpaid.**

Wonderful X-Ray Tube

A wonderfullittle instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price **10c, 3 for 25c, 1 dozen 75c. Johnson Smith & Co.**

Good Luck Ring

Quaint and Novel Design

A VERY striking and uncommon ring. Silver finish, skull and crossbone design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, Good Luck Ring. Very unique ring that you will take a pride in wearing. ONLY 25 CENTS.

Exploding Cigarettes

JUST LIKE ORDINARY CIGARETTES, BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud **BANG!** A great mirth provoker yet entirely harmless. **Price 25c per box.**

Popular Watch Charms

15c

ONLY 3 for 40c; $1.35 doz.

Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

CIGARETTE MAKER

Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs ½ oz. Made entirely of metal, nickel-plated. **Price 25c postpaid.**

MAGIC FLUTE

Wonderfully Sweet Toned and Musical

Post Paid 25c

The Magic Flute, or Humanatone, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produce very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument the effect is as charming as it is surprising.

Novelty Badges

Kissing Permit 10c. Garter Inspector 10c

Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. **10c, each badge, 3 for 25c, or 75c per doz. p.p.d.**

BLANK CARTRIDGE PISTOL

Price $1.00 Postpaid

This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard .22 Calibre Blank Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. **A Great Protection Against Burglars, Tramps and Dogs.** You can have it lying about without the danger attached to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. **PRICE ONLY $1.00 Postpaid. Blank Cartridges 22-cal. chambered for express only, 50c per 100. Johnson Smith & Co., Dept. 557, Racine, Wis**

Sneezing Powder

Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. **For parties, political meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 10c or 3 for 25c**

Mystic Skeleton

10c ppd.

A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most lifelike manner. **Price per box 10c ppd.**

BOYS! BOYS! BOYS!

THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

THE VENTRILO

a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it.

Never Fails. A 32-page book on ventriloquism, and the Ventrilo, ALL FOR 10c postpaid.

ITCHING POWDER

This is another good practical joke; the intense discomfiture of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more.

10c box, 3 boxes for 25c or 75c per doz boxes postpaid.

Great Fire Eater

Most Sensational Trick of the Day!

With the Fire Eater in his possession any person can become a perfect salamander, apparently breathing fire and ejecting thousands of brilliant sparks from his mouth, to the horror and consternation of all beholders. Harmless fun for all times, seasons and places. If you wish to produce a decided sensation in your neighborhood don't fail to procure one. We send the Fire Eater with all the materials, in a handsome box, the cover of which is highly ornamented with illustrations in various colors. **Price** of all complete only **30 cents,** postpaid.

SQUIRT ROSE

25c

A REAL STARTLER. This is the most popular of all squirt tricks. The flower in your coat looks so fresh and sweet that everyone is tempted to inhale the delightful perfume. Then is the moment to press the bulb. Goswhillikens! Don't they jump! There is a very long rubber tube that easily reaches to the pocket of your coat or trousers, and the bulb is large enough to make a dozen shots with one loading. **PRICE 25c** *each, or 3 for 65c postpaid.*

LOOK 35¢ Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngascope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. **Price, only 35c or 3 for $1.00** postpaid.

JAPANESE ROSE BUSHES

The Wonder of the World

10 Cts.

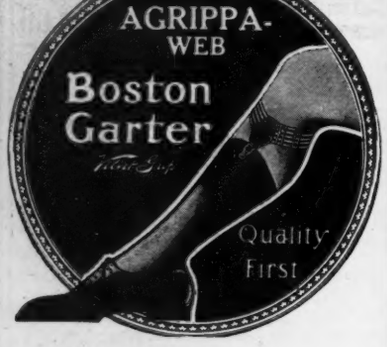
Japanese Rose Bushes **bloom all the year round.** Just think of it. Six weeks after planting the seed, the plants will be in **full bloom.** It may not seem possible, but we positively **guarantee it to be so.** They will **bloom every ten weeks,** Summer or Winter, and when three years old the bush will be a **mass of roses,** bearing from five hundred to a thousand roses on each bush. The flowers are in three shades—white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. **Price, 10c** packet, 3 pkts. for **25c** postpaid.

ADDRESS ORDERS FOR ALL GOODS ON THIS PAGE TO

JOHNSON SMITH & CO. DEPT. 557, RACINE, WIS.

Postage Stamps Accepted

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



No More Skidding Garters!

AGRIPPA-WEB makes garters act in an entirely new way—and only in Bostons can this web be had. Even when worn very loose it will not slip. It cannot curl and yet it is remarkably soft and light. Here in fact is the first practical ventilated web garter.

In many pleasing colors, 50c the pair.

GEORGE FROST COMPANY, Boston, Makers of Velvet Grip Hose Supporters for All the Family.

How Did Your Garters Look This Morning?

Easy to Make

Enjoy the thrills of making countless things of wood and metal to beautify your home and garden—make toys, furniture, repair the car, polish golf clubs, do radio jobs, etc.

Trellis

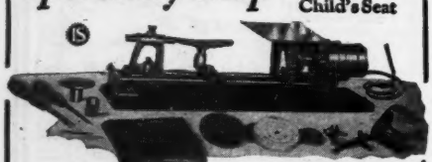
Tea Wagon

Child's Seat

Free Instructions

We furnish complete blue prints and instructions for making the items shown, and dozens of other useful articles with

SpeedWay Shop



SPEEDWAY SHOP AND TOOLS

Six motor-driven tools—Saw, Lathe, Grinder, Buffer, Cleaner, and Drill, making complete outfit for mechanics, householders, farmers, and "handy-men."

Only $10 Down, Easy Payments

Pay as you enjoy it. Use the *Shop* for pleasure or profit.

Write Today For Full Information

Every tool in the "Shop" is high grade, for regular work. A money maker for the small job man. Write today.

Electro-Magnetic Tool Company

Dept. 57, 1830 S. 52nd Ave., Cicero, Ill. (Adjoining Chicago)

CARTER

NEW "SHORT" JACKS

Small—sturdy. Carter quality. Takes up minimum space in set. Solder lugs widely spaced, permit easy soldering. All possibility of short circuiting and leakage eliminated.

25c EACH. Closed Circuit 30c ea.

Write for illustrated folder.

Any dealer can supply.

RMA

In Canada: Carter Radio Co., Limited, Toronto

Carter Radio Co.
300 S. ENGINE AVENUE
CHICAGO, ILL. U.S.A.

Better Shop Methods

Driving a Countershaft at Right Angles

A LETTER was received the other day addressed to Old Bill, the machine shop character whose mechanical short-cuts and shrewd observations have long been a feature of this department. It was as follows:

> I have a simple problem which I know you can solve quickly, although it is bothering me quite a bit. I wish to run a countershaft at right angles to my line shaft. What is the best and least expensive manner in which this can be hooked up?
>
> The countershaft should run about 500, the main shaft turns 1,000. Outfit should carry about three horsepower, although my present work will use only about one third that.—F. H. C., Mannsville, N. Y.

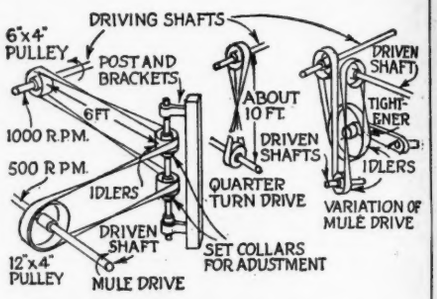
While there are several solutions of the problem of running one shaft at right angles to another, it is almost impossible to say with definiteness which is better without knowing all of the conditions.

Gear manufacturers have developed their art to the point where they can supply gear boxes to meet any speed condition, and probably this would be the best construction, though the most expensive. Do not make the mistake of trying to run ordinary gears out in the open at this speed. For successful operation, it is necessary that the two gear shafts be mounted in rigid bearings, and that there be an ample supply of oil.

The least expensive method, and the one that I should ordinarily recommend, would be to use a belt. The traditional scheme involves the use of a so-called mule stand, which is a vertical shaft carrying two idler pulleys. Sometimes the pulleys are carried on separate shafts, each capable of some angular adjustment.

This arrangement works very well in the usual conditions, although the belt must be kept very tight in order not to run off the pulleys. For a speed of 1,000 revolutions per minute on the line shaft and for three horsepower, I should recommend that the pulleys be 6 and 12 in., and that a 3-in. belt be used. The distance from the pulleys to the mule shaft should be not less than 6 ft. and perhaps should be more, for this type of drive is at a disadvantage with pulleys of different sizes, and the farther apart the pulleys are, the better the installation will be. The mule pulleys should be about 12 in. in diameter and of at least 6-in. face. They should be arranged so that they can be moved up and down in order to make the belt stay properly on its track.

The problem does not state whether the shafts are both at the same elevation. If they are some 10 or 12 ft. apart, as would be the case if the driven shaft could be put under the floor, a simple quarter-turn belt can be put on, which will give very satisfactory service. If the conditions will permit, this will be better than the mule drive. The same size pulleys and belt would be used.



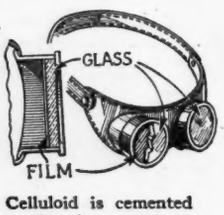
Diagrams showing the most common model of mule drive, a variation of that drive, and, center, an ordinary quarter-turn drive

Another variation of the mule can sometimes be used where the shafts are at about the same level, and has the advantages that the belts will always run properly and that the tension of the belt can be regulated. Here the idler pulleys are on the floor, and the belt goes down and up. One of the idlers can be arranged to be adjustable. The diagonally placed idler should be set so that the centers of its faces coincide with the centers of the faces of the driving and driven pulleys. —JAMES ELLIS.

Safety Eye Protectors Made from Cheap Goggles

IN FIVE and ten cent stores very cheap eye goggles may be purchased. In spite of their low cost, these goggles may be converted into serviceable eye protectors for the machinist or metal worker.

The glasses with which these goggles are fitted are first cleaned. To the back of each is cemented a transparent disk of celluloid. If no other celluloid is at hand, the disks may be cut from photographic film from which the emulsion has been removed. Any celluloid cement may be used, or a cement made up by dissolving celluloid chips or small cuttings in acetone.—W. J. E.



Celluloid is cemented to the glass eyepieces

ELECTRICITY now has been called into use in experiments to give loose belts a firm grip on the pulleys. The electric phenomenon utilized is known as the Johnson-Rahbeck effect. It presupposes the use of metal pulleys, coated with any smooth, hard and durable insulating substance. The friction of the belt causes it to become charged with electricity on its inner surface. The metal of the pulley becomes charged by induction with electricity of the opposite pole and a strong attraction between belt and pulley is developed.—ERNEST WELLECK.

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

ABDON F LAUS
Saxophonist and Teacher
Director of
Boston Saxophone Orchestra

You can play

this easy fingering Buescher Saxophone. Most wonderful music. 3 lessons given on request with each new Buescher True-Tone. Teach yourself. Many play scales right off—easy tunes first week. You can.

Easy to Play, Easy to Pay 3250

Try any Buescher Instrument for 6 days. Satisfaction or no sale. Easy terms arranged. Send postal for catalog and details of trial and payment plans. Mention instrument preferred. No obligation. Send today.

BUESCHER BAND INSTRUMENT CO.
1517 Buescher Block Elkhart, Indiana

Grow Taller

Science has found the way to add inches to your height. No need to envy and look up to the big fellows. No need to have the disadvantages of the little man. This course makes it possible for you to be on a level with your fellow men. Course is easy, inexpensive and results sure. Mail coupon for free information today!

L. GLOVER,
Room 17, 459 San Carlos Ave.,
Sausalito, Calif.

Without any obligation to me, send me full information on how to grow taller.

Name.....

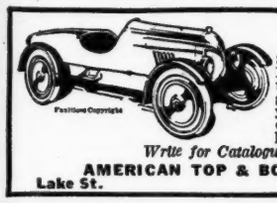
Street.....City.....

Squab Book FREE

Printed in COLORS. Enlarged. Much News.

Squabs are raised in one month, they sell for high prices. Greatest market for 20 years. Make money breeding them. We ship everywhere *on three months' trial* our famous breeding stock. All pigeon supplies. Established 25 years. For prices and full particulars *see our beautiful free book*, "*How to Make Money with Squabs*," with pigeons in colors. Write for it today.

PLYMOUTH ROCK SQUAB CO.
616 H St., Melrose Highlands, Mass.



Direct from Factory

$39.00 buys this RACEABOUT torpedo body in gray prime for your Ford. Special hood and bullet nose shell.

Write for Catalogue

AMERICAN TOP & BODY CO.
Lake St. Delphi, Ind.

BUCHSTEIN'S FIBRE LIMB

is soothing to your stump—strong, cool; neat, light. Easy payments.

Guaranteed 5 Years
Send for Catalog Today

Braces For all deformities

P. BUCHSTEIN CO., 610-3rd Ave., So., Minneapolis, Minn.

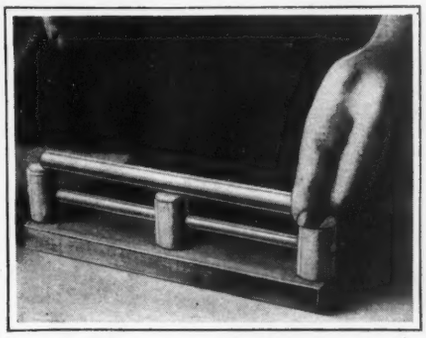
A 2c Stamp

—will start you on the road to success. See Money Making Opportunities on pages 104 to 127.

Better Shop Methods

Straightening Attachment for Bench Plate

WHEN straightening short rods or shafts on a small bench plate, a much harder blow than is really necessary must be delivered because the work is backed up against its entire length on a flat surface. It is much better to support the work on two points only; then a light blow will bend the piece more than is necessary to bring it straight, and the natural



The rod to be straightened is rested upon two anvils, which can be adjusted laterally

spring of the metal will force it back to parallel. Contact points for this use obviously should be adjustable. The attachment illustrated was designed for this.

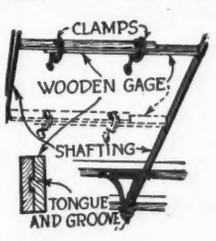
A hole was drilled in the bench plate and a piece of round stock driven in. This piece carries at right angles a tightly driven rod, and at either side is a sliding anvil made from round steel somewhat higher than the central piece.

In operation, the work is rolled along the flat plate and the high spots are noted; then the anvils are pushed in or out and the bending is done.—H. MOORE.

Gage for Alining Shafts

AN INEXPENSIVE gage for alining shafting consists of two pieces of light, slender, stiff wood and two clamps. When the pieces are clamped together to give the correct length, it is a very simple matter to check up two shafts.

This gage is far superior to a cord because it does not stretch or shorten and may be handled with greater ease and certainty. If flooring or other tongue and grooved stock is used for making the gage, the two pieces may be adjusted still more quickly.—W. F. SCHAPHORST.



How the gage is made and used

Two Useful Compounds

FOR polishing brass, add 3 oz. of powdered rotten stone and 4 oz. oxalic acid to 2 qts. of rain water. Mix well and let stand for a day or two before using. A paste for razor strops may be made of 1 oz. levigated oxide of tin, ¼ oz. powdered oxalic acid, and 20 gr. powdered gum mixed with a small quantity of water. Rub into rough side of strop.—F. N. C.

Heats 7 Rooms
at about the
Cost of One!

"With the Bulldog Furnace, we find it takes little more coal to heat the whole seven room house than it did to heat one room with a stove using chestnut coal." J. B. Smith, 19 Elm St., Somerville, N. J.

More Heat with Half the Coal

"I had a hot air furnace in our house before I got the Bulldog and our 7-room house was always cold. With the Bulldog it only takes *half* as much coal and we had weather below zero, and the house was nice and warm in the morning when we got up. We never have the draft on more than a half hour at a time, and it has the place red hot." Jess T. Conrad, Shamokin, Pa.

BULLDOG PIPELESS FURNACE

Comes Completely Erected!
You Install It Yourself!

If you are even thinking of a pipeless furnace, or any furnace, write for our free catalog. The Bulldog is one furnace you MUST investigate. **Comes completely erected, fits any height of basement, goes through any door, and you install it yourself!**

No Money Down!

The Bulldog is sent you for *free* inspection. Then, if satisfied, you make only small monthly payments, at our amazingly low price! Factory connections in both East and West. We ship from nearest point. Don't consider buying any furnace until you find out about the Bulldog. Write at once for our special offer and our free catalog together with the wonderful record of Bulldog success. Get ready for winter NOW! Mail this coupon TODAY!

Bulldog Furnace Co.
Babson Bros., *Sole Distributors*
19th and California Ave., Dept. B-136 Chicago

Without obligating me in any way please send me your free catalog and special offer on the Bulldog Pipeless Furnace.
(Print name and address plainly)

Name.....

Address.....

This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

Money Making Opportunities
for Readers of Popular Science Monthly

FREE RAILROAD FARE
TO CHICAGO WHEN YOU ENROLL

You Can Learn Electricity in Only 12 Weeks — Earn Up to $300 per Week

Get PRACTICAL Training in the Great Shops of COYNE

Student Winding Stator

Make Your Career a Happy One

in the Clean, Fascinating, Profitable Field of *ELECTRICITY. COYNE-Trained Men Are in Demand.* Here's a proposition that should arouse the enthusiasm of every red-blooded, ambitious fellow. Why not make this your happiest and most profitable season? Come to Chicago, the great, interesting resort city and place of big opportunities. I'll pay your railroad fare here, and you can prepare yourself, in 12 happy weeks at COYNE ELECTRICAL SCHOOL, to join the ranks of successful *Big Pay* men. Why gamble on other lines of work when the field of Electricity offers millions of amazing opportunities?

Complete Electrical Training in 12 Happy Weeks
—Not by Correspondence—All Practical Work—

I have started thousands of men, young and old, on the road to success and independence. I can do the same for you. I teach you everything in Electricity from A to Z, by *practical* instruction. Nothing that will help to make you a success is left out.

Experience, Education — Not Needed

I can teach you electricity in 12 weeks, regardless of your education or experience because I teach you every detail in a simple, logical, PRACTICAL manner, letting you work out problems on thousands of dollars' worth of modern electrical apparatus in my great COYNE shops. My instructors are trained men with years of experience.

Learn in Chicago, Electrical Center of the World

Chicago is the great electrical and industrial center, therefore it presents real opportunities for you. Along with my shop training you visit the big industrial organizations and power plants and see every kind of electrical equipment in operation, on every kind of job, under all conditions.

Send Coupon Now for My Big, New FREE Book!

Right now I am making one of the greatest offers ever made by a Practical Training Institution. My offer includes FREE RAILROAD FARE to Chicago from any place in the U. S.; also extra special FREE Radio and Auto Courses. Be sure to send the coupon AT ONCE, even if you are not planning to come immediately.

EARN While You LEARN

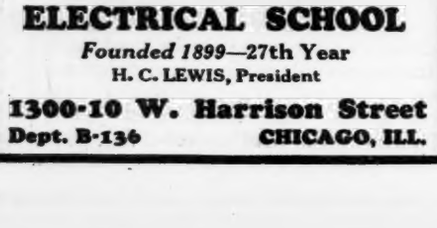
My Employment Department helps you get a job to earn a good part of your expenses and assists you to a good job on graduation.

Hear WGES on the Air

Listen in on COYNE Radio Station WGES; wave length, 250 meters. Always an interesting program.

You'll Enjoy a Season in Chicago—the Wonderful Resort City

Chicago, on beautiful Lake Michigan, is the Nation's Playground. Free Bathing Beaches, Beautiful Parks, Excursion Boats and the great Municipal Pier, Zoos, Ball Parks. The daylight saving plan makes it possible for you to enjoy all these and still have plenty of time for your Electrical education.



H. C. LEWIS, President
Coyne Electrical School
1300-10 W. Harrison St., Dept. B-136
Chicago, Illinois

Dear H. C.—I sure want one of these big handsome 12x15 books with 151 actual photographs printed in two colors. Send it quick without obligating me. Also tell me about the *Free Railroad Fare and Two Free Courses.*

Name.....

Address.....

Town.....*State*.....

COYNE
ELECTRICAL SCHOOL
Founded 1899—27th Year
H. C. LEWIS, President
1300-10 W. Harrison Street
Dept. B-136 CHICAGO, ILL.

Prize Winners in the May Contest

(*Continued from page 4*)

A. C. Rose of Wilkinsburg, Pa., wins the first prize of $50 for his letter on the value of the International Correspondence School Course and their textbooks, which he points out have a permanent value as "reference books or trouble shooters." Mr. Roe's prize-winning letter follows:—

Contest Editor:

The International Correspondence Schools advertisement states that "You can't beat those I. C. S. textbooks for good sound practical knowledge." I'll tell the world you can't, as I was forced to leave public school and soon realized that to advance in any pro-

(*Continued on page 105*)

$100 in CASH PRIZES

For the best letter of 170 words or less answering the question—

"What advertisement in the 'Money-Making Opportunities' Section interests you most—and why?"

we will pay on August 10th the following—

CASH PRIZES	
First Prize	$50.00
Second Prize	25.00
Third Prize	10.00
Fifteen Prizes of $1.00 Each	15.00

First read every advertisement in the Money-Making Opportunities Section on pages 104 to 127. Pick out the one that interests you most and then write a letter—*not exceeding 170 words*—telling us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on August 1st. The prize winners and their letters will be published in the September issue of POPULAR SCIENCE MONTHLY.

Address your letter to

Contest Editor

MONEY-MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

Prize Winners in the May Contest

(*Continued from page 104*)

fession, a thorough knowledge of the fundamental principles was essential. This led to an I. C. S. Electrical Engineering course, which also helped my grammar and spelling.

The Westinghouse Electric Company is full of I. C. S. men in good positions, and I consider myself in this class, being at present Section Engineer in charge of Coils and Insulation, Homewood Plant, formerly Repair Superintendent, Detroit Service Dept., also author of four books.

The above built on the foundation laid from the fundamental facts given in I. C. S. textbooks, which are also excellent reference books, or trouble shooters, that can be used to overcome everyday problems.

Yours truly,
A. C. ROE

THAT the graduate of a technical school has certain advantages over the college man who takes an A. B. course is forcibly brought out by William O'Neill, Jr., of Downers Grove, Ill., in his letter telling how Chicago Technical College started a friend of his on the road to success. Mr. O'Neill's letter wins the second prize of $25.

Dear Sir:

The "tech" school graduate has one advantage over the college man: he can cash in on his knowledge sooner. This fact was brought home to me by the following interesting occurrence.

When our high school class graduated three years ago, most of us went to college to make our marks. But one lad couldn't make it. He went to work as timekeeper for a local contractor—and went to night school at Chicago Tech.

The following spring his employer took him into partnership.

Six months later—last fall—he left cold Chicago to be consulting engineer to a Florida land development company.

This has shown me the value of a *practical* education.

Yours truly,
WILLIAM O'NEILL, JR.

RAY Lindholm of Everett, Washington, tells how his lack of opportunity for education through the public schools was more than offset by taking a course with L. L. Cooke, Chief Engineer, Chicago Engineering Works. The third prize of $10 goes to Mr. Lindholm for this letter:

Contest Editor:

The ad that I shall never forget or repay in your Money Making Opportunities is the one of L. L. Cooke, Electrical Training at Home.

When I enrolled, I did not know the first thing about electricity, as my education was cut short by having to go to work real young, but let me say there is no excuse for a man not knowing when opportunities were never greater, which the ads in your magazine point out. I am not only learning fast, only having taken 28 lessons, but I have invented an automatic switch which I have been able to build with my little studying each night, which I know will help the electrical world. I also have more ideas to put on the market.

I am writing to one of your Patent Attorneys ads, where I found Cooke's wonderful training, to obtain a patent for me.

Yours respectfully,
RAY LINDHOLM

Thousands of people write every year telling us how they have been helped to win success, and all that success brings

(*Continued on page 106*)

3 Drafting Lessons Actually FREE!

to prove you can learn at home in spare time!

We have invented a new, simplified way to teach Drafting—the first real improvement in Drafting home-instruction in history. We want you to see it, try it—without one penny of cost or obligation. We want to show you how we get away from the *copying* methods used in the past. See how we make you *think*, solve problems, do actual drafting room jobs *from the first lesson!*

I will make this contract with you:

When you enroll for our home-training in Drafting, we agree to give you:
1. Complete Drafting training, by the new Practice-Method.
2. Professional Drafting Outfit, as illustrated.
3. *We will help you get a good Drafting position* at a substantial increase in pay.
4. Or we'll refund every cent of your money.

O. C. Miller

The American School, a million dollar *No-Profit* Educational Institution now offers men a *double* service—training for a specific job, then finding the job. For one small price, on terms of only $5 a month, you are now assured of definite benefits, both in position and salary.

Coupon brings complete details of this sensational offer!

Draftsmen WANTED!

70,000 fine jobs advertised this year, many at $60 to $125 a week. Get ready to fill one. Get out of the rut. Make something of yourself. Plan *your future* in Drafting. Even if you have only common schooling, even if you know nothing of Drafting, we guarantee to make you a real Draftsman *or to refund your money!* Special surprise offer right now to the first 500 men who answer this ad—reduced price, easy terms. Coupon brings complete information.

A new, rapid, simplified way

This new "Job-Method" gives you actual drafting-room jobs in a new one-step-at-a-time way. With *pictures* which you can understand almost without reading the "lessons." And that is why American School-trained Draftsmen can qualify for a good job at big pay when they graduate.

5 HIGHWAYS TO SUCCESS!

The big money in Drafting goes to men who specialize in Machine Design, or Electrical Drafting, or Architectural Drafting, or Structural, or Automotive. It isn't enough merely to know *general* Drafting practice. You must know how to calculate and design and plan original work. You need many Engineering subjects to fill the kind of a Drafting position that pays $60 to $125 a week. The American School *now includes this specialized training in its Drafting course.*

Job Service *Free to Students and Graduates:*

THE AMERICAN SCHOOL now offers its students and graduates, without cost, the services of an efficient Employment Department which keeps in touch with the employers of Draftsmen all over the United States. *We have placed hundreds of men in good Drafting positions.* We have made this training so complete, so practical, so easy to master, that our students *are bound to make good.* And, so, because the demand for real Draftsmen continues to exceed the supply and because this training actually prepares men for good Drafting positions, *we back it with a Free Employment Service, free to employers, students, graduates.*

Professional Outfit Given

Fine, imported instruments help you learn Drafting easily and quickly. These standard quality, full size instruments, including board, table, triangles, T-square, ink, protractor, etc. Given without extra charge to students.

COUPON *Brings 3 Lessons Free*

Get them. Test your own ability to learn Drafting and get ready for a fine job and big pay. Coupon also brings surprise offer, and complete information about your opportunities for success in Drafting. *MAIL IT TODAY!*

Chief Drafting Engineer
AMERICAN SCHOOL
Dept.
Drexel Ave. & 58th St., Chicago

Rush 3 Free Drafting Lessons, surprise offer, complete information, money-back guarantee, etc., to prove I can become a real Draftsman at home in spare time.

Name.....

Street No.....

City..... State.....

Chief Drafting Engineer

American School Drexel Ave. and 58th St. Dept. DB-75 Chicago, Ill.

This Ornamental Trellis Work Will

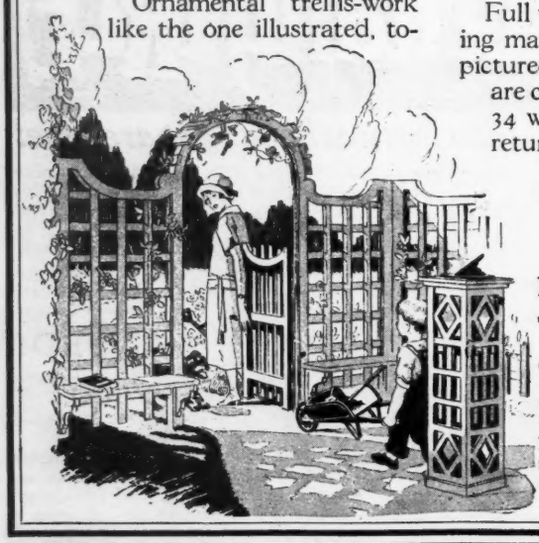
Add Charm to Your House or Garden

BEAUTIFUL as this trellis is, it is surprisingly easy to build and well within the ability of any man handy with woodworking tools. And the construction is sturdy enough to insure the trellis lasting for years.

Ornamental trellis-work like the one illustrated, together with other designs for trellis-work, are available in the Home Workshop Blueprint No. 34.

Architects often use well designed and carefully placed trellises to give an added attraction to poorly proportioned houses.

Full working details and building material for trellises such as pictured in this advertisement are contained in Blueprint No. 34 which will be sent you by return mail on receipt of 25c.



POPULAR SCIENCE MONTHLY
250 Fourth Avenue
New York, N. Y.

MAIL TODAY

I am enclosing 25c for which please send me Blueprint No. 9 of the Arbor, Gate and Swing.

Name.....
Street.....
City and State.....

COPY THIS SKETCH

and let me see what you can do with it. Cartoonists trained by this school are earning from $50.00 to $200.00 or more per week. The Landon Picture Chart Method of teaching makes original drawing easy to learn at home in spare time. Send sketch with 6c in stamps for full information and sample chart to test your ability.

Please state age.

THE LANDON SCHOOL
1451 National Bldg. CLEVELAND, O.

"STAMMERING"
Its Cause and Cure"

You can be quickly cured if you stammer. Send 10 cents, coin or stamps, for 288 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.

BENJAMIN N. BOGUE
7531 Rogue Bldg., 1147 N. Ill. St. Indianapolis

Play "JAZZ" on the Saxophone

Become a musician so quickly as to astound everyone. Learn by playing **real** music—instead of tiresome "exercises." You'll soon become the most popular person in your "set."

New Easy Method

is a revelation. Nothing else like it for thoroughness and rapidity. So simple that young and old find it easy to play with amazing skill. No "trick music" — but actual notes, learned quickly right in your own home.

FREE BOOK and Demonstration Lesson

offer this wonderful musical opportunity. Send for them today before copies are exhausted. You'll be astounded, thrilled, fascinated, at this easy, rapid way to become a veritable **master** of your favorite instrument. Instruments supplied when needed, cash or credit.

LEARN TO PLAY ANY INSTRUMENT

Piano	Mandolin
Organ	Drums and Traps
Violin	Harmony and Composition
Banjo (Tenor, Plectrum or 5-String)	Sight Singing
Clarinet	Ukulele
Flute	Piccolo
Harp	Trombone
Cornet	Saxophone
Cello	Voice and Speech Culture
Guitar	Automatic Finger Control
	Piano Accordion

U. S. SCHOOL OF MUSIC, 87 Brunswick Bldg., NEW YORK CITY

Send me your amazing free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane; also Demonstration Lesson. This does not put me under any obligation.

Name.....
Address.....
Have you this Inst.?
Instrument.....

I'll End Your FEARS in 48 Hours

David V. Bush

Give me 5 days and I'll prove to you that I can give you real courage—courage that wins—courage that crushes all obstacles. I can give you Grit and Gumption enough to fight your weight in wildcats.

By DAVID V. BUSH

The Man Who Destroyed Fear

Are you afraid of people? Are you afraid of your superiors? Are you afraid of Public Opinion? Give me 48 hours and I'll prove I can banish all your fears —now and forever.

Don't be a cringing, crawling imitation of a man. Brace up.....Throw your shoulders back.....Stick your chest out! Show folks who you are. Show folks you've got a good opinion of yourself and they'll respect you and look up to you.

Grit and Gumption Wins

You must see this new book in which Dr. Bush gives his secrets of real, he-man courage. It is called "Spunk." You can't read it without a quickening of your pulse —without a new surge of red-blooded courage.

This book is declared to be the masterpiece of Dr. Bush, who has astounded throngs in America's greatest cities and shown thousands the one way to health, prosperity and happiness. Write for this amazing book today. Send only 50 cents in full payment. If you are not delighted, return the book within 5 days and your money will be instantly refunded.

DAVID V. BUSH, Publisher
225 N. Michigan Blvd., Dept. K-957, Chicago, Ill.

Prize Winners in the May Contest

(Continued from page 105)

with it, through the opportunities presented by advertisers in POPULAR SCIENCE MONTHLY.

There are today just as big opportunities for you as there were for the men who wrote the letters we have quoted. Just fill in now the coupons or write the advertisers in the Money Making Opportunities Section who are ready to help you reach the top of the trade or profession you have a natural bent for.

Take the first step along the road to success by writing today to the advertisers whose offers interest you most. These advertisers have specialized in fitting men for success. Get your share of the good things in the world by taking advantage of the money making opportunities in this section.

Complete List of PRIZE WINNERS in the May Contest

FIRST PRIZE $50
A. C. Roe, Wilkinsburg, Pa.
(International Correspondence Schools)

SECOND PRIZE $25
William O'Neill, Jr.,
Downers Grove, Ill.
(Chicago Technical College)

THIRD PRIZE $10
Ray Lindholm, Everett, Washington
(Chicago Engineering Works)

PRIZE WINNERS who receive $1.00 each for their letters:

W. A. Ripley, St. Francis, Wis.
(International Correspondence Schools)

L. D. Hall, Huntsville, Ala.
(The Rhodes Manufacturing Company)

Mrs. M. A. Baker, Cooper, Texas
(Miller)

W. B. Calhoun, Rapid City, S. D.
(Theo. Audel & Co.)

Homer Sherman, Strawn, Texas
(Chief Draftsman Dobe)

Mrs. May Huskin, Pecan Gap, Texas
(Sweeney Automotive & Electrical School)

W. R. Glaze, McCook, Nebr.

A. D. Abrams, Wilmington, Del.
(National Salesmen's Training Assn.)

Joseph H. Lear, Charleston, S. C.
(Chicago Engineering Works)

Jack L. Baker, Cooper, Texas
(International Correspondence Schools)

Mrs. L. E. Davis, Harrisonburg, Va.
(La Salle Extension University)

Kenneth McKenzie, Alba, Texas
(Blueprints—Popular Science Monthly)

J. H. Cherrington, Gallipolis, Ohio
(Clarence A. O'Brien)

A. M. Crowell, Dartmouth, N. S.
(Chicago Engineering Works)

R. W. Carr, Parkersburg, W. Va.
(International Correspondence Schools)

Do You Make These Mistakes in English?

Did you hear from him yet? will be pleased to go.
That's between you and I. Everyone stood up in their places.
Who was it sent to? I have three sister-in-laws.

Free—New Book on English

No one willingly makes mistakes in English. But such mistakes do untold harm, for poor English makes others judge us unfairly as uneducated and lacking in culture. Remove the handicap that poor English may be causing *you*. Sherwin Cody's remarkable new method automatically gives you masterly command of English in only 15 minutes a day. Increases power of expression, enlarges vocabulary, improves spelling, grammar, diction. No rules to memorize. No drudgery. Like a game. Over 40,000 already helped. Free book explains everything. Write for it today.

Sherwin Cody School of English, Dept. 187 Rochester, N. Y.

BE A PLUMBER *and* HEATING EXPERT

Here's the opportunity of a lifetime for men who want to learn a real trade. Thousands of trained plumbers making from $75 to $150 a week. A few short weeks in our shops will fit you for any branch in the plumbing field. Here you learn lead wiping, building and construction work, jobbing, estimating, blue prints and specifications. No books, all actual, practical work under the supervision of master plumbers. Plumbers' opportunities are everywhere, in the cities, small towns and the country.

Send for our FREE booklet on how you can earn your expenses while learning in the worlds largest plumbing school.

ILLINOIS PLUMBING WORKS SCHOOL
512-514 N. LA SALLE ST. DEPT. 4
CHICAGO, ILLINOIS

This Year—make it a Real Vacation!

Thrilling, foaming speed with the Super Elto outboard motor! Instantly attached to any rowboat. Easily portable. World famous for easy starting. Multiplies the pleasures of fishing, racing, vacationing. Write today for new catalog—beautifully illustrated—intensely interesting.

Elto Outboard Motor Co.
Ole Evinrude, Pres.
Dept. W, Mnfrs. Home Bldg.
Milwaukee, Wis.

The **Super Elto**

"Starts With a Quarter Turn"

MADE IN U. S. A. TYPEN TRADE MARK

TYPEN

Fountain-Pen-Typewriter.
Quick, Valuable, Readable Writer.
Great Indexer, Check Writer and Labeller, W't, 1 oz.
Complete with Ink and Pocket Case, $10.00.
(U. S. Pat. 1,571,656. Co.)
Booklet
H. E. W.'S Specials, Audubon, Pa.

Doubles Life! ~ of Auto Tires

MANY MAKE $15 A DAY EASILY. Amazing new invention doubles life of tires. With it new tires give 22,000 miles. Tires ready to be thrown away give 5,000 more miles. Cuts tire bills in half. Costs little, sells on sight. Full or spare time. Exclusive territory. No experience or capital required. Free Sample. **Dept 237 Unusual Products Co., New Rochelle, N. Y.**

Forest Rangers

Men wanting Forest Ranger, Railway Mail Clerk, Special Agent, and other government positions, $1500 to $2600 a year. Write for free particulars and list of positions.

MOKANE, Dept. 218, Denver, Colo.

The Real Estate Educator

This book gives a most comprehensive yet most concise arrangement of useful facts about buying, selling, leasing and sub-letting of Real Estate, contracting, for erection or repairs, mortgaging, transferring, insuring, etc. Cloth, 256 pages. Price **$2.00**, postpaid. POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City

The Magic Eye That Sees across the Ocean

(Continued from page 19)

shadows of varying intensities.

Right here an amazing thing happens. Every time the light flashes through the little window, the sensitive coating on the walls of the bulb sends forth a bombardment of little particles of matter known as electrons. Immediately these electrons form a path of escape for the electricity dammed up in the connecting wires under pressure from the battery. As the electrons jump across to the metallic element at the center of the bulb, a circuit is completed, and electric current flows. This current, "stepped up" by amplifiers, operates the sending instrument.

THUS, for every patch of light on the picture we have an electrical impulse, varying in intensity according to the intensity of the light. These are the impulses that are carried by radio or wires across thousands of miles.

Various methods have been employed to pick up these impulses at the receiving end and translate them back into pictures, although the function of the photo-electric cell is virtually the same in every case. In one method, for example, the impulses are made to actuate a pen which draws parallel lines of dots and dashes corresponding to the shadows in the original picture. In another, a beam of light varying in intensity according to variations in the electric current moves in parallel lines across a photographic film.

While the successful transmission of pictures is a comparatively recent achievement, the photo-electric cell is not new.

Its history dates back to 1817, when J. J. Berzelius discovered the element selenium. In its normal state, selenium is a poor conductor of electricity, but under a beam of light it instantly becomes a good conductor. Thus the first photo-electric cell was a selenium cell translating light variations into electric variations.

YEARS ago Alexander Graham Bell, the inventor of the telephone, struck by this property of selenium, made use of it in an instrument for transmitting spoken words to a distance by means of a beam of light. This instrument he called the photophone, and later the radiophone. In more recent years the selenium cell has been employed in the invention of talking movies, notably by Dr. Lee De Forest.

For the transmission of pictures, selenium now has been replaced by the so-called alkali metal photo-electric cell already described, because selenium, while highly sensitive to light, was found to be too slow for picture transmission.

This matter of speed has become an all-important factor with engineers in perfecting a system of television. Thus far the best speed attained in transmitting a photograph by wire is about four minutes. On the average, it takes about twenty minutes to send a photograph by radio. Yet to produce an action picture that will appear lifelike requires the speed of a motion picture film—sixteen photographs a second.

It's a long gap between the two. Still, inventors today say they are bridging it.

Magic

Learned Easily At Home

Dr. Harlan Tarbell
Master of Magic who has mystified magicians as well as laymen with his marvelous magic.

Astonish Your Friends—

Gain that magnetic popularity that makes you the center of any crowd. Business and social success is assured the man who can perform mystifying tricks. You can earn big money either on the side or as a professional, as well as being the most popular person in your crowd. Why envy others' skill? You can learn Magic yourself, quick and easy.

Earn Up to $1000 a Month

Even slight-of-hand, generally supposad to require long practice, is NOW made simple to learn. For Dr. Harlan Tarbell, one of the really Great Magicians, has finally opened up the secrets of his profession in a completely illustrated course offered at a merely nominal cost. Through the wonderful Tarbell System you will be able to mystify and entertain your friends with simple tricks taught in your very first lesson. After that Dr. Harlan Tarbell takes you through the entire maze of slight-of-hand, card tricks and elaborate stage divertisements. The apparently superhuman doings of the accomplished magician becomes as simple as ABC when you just know how.

Mail Coupon *for* Special Offer!

There is a tremendous demand for magic entertainment. Clubs, Lodges, Charity and Social affairs—all will pay high fees to the man who knows Magic. Dr. Harlan Tarbell really gets as high as $250 for a half hour's work right now. Opportunity everywhere to make money aside from your regular occupation. Salesmen find it a tremendous asset. Find out all about this unprecedented opportunity to learn Magic. The coupon brings full details without any obligation. Mail it TODAY.

Tarbell System, Inc.
1926 Sunnyside Ave., Studio B-136, Chicago

Tarbell System, Inc.
1926 Sunnyside Ave., Studio B-136, Chicago

Tell me all about Dr. Tarbell's new and simple system by which I can learn the secrets of MAGIC. No obligation on my part.

Name .....

Address .....

..... *Age* .....

"They've tripled your salary, dear"

"I TELL you, Tom, it was a lucky day for both of us when you sent in that I. C. S. coupon. You'd never be where you are to-day if you hadn't decided to study in spare time just when you did."

Spare-time study with the I. C. S. is winning promotions for thousands of men and bringing happiness to thousands of homes all over the world. In offices, shops, stores, mines, mills and on railroads, I. C. S. trained men are stepping up to big jobs, over the heads of older men, past those whose only qualification is long service. There is a job ahead of YOU. Some man is going to be picked for it. The boss can't take chances. He is going to choose a trained man with sound, practical knowledge of the work.

Get busy right now and put yourself in line for that promotion. You can do it in spare time in your own home through the International Correspondence Schools, just as thousands of other men and women have done.

The first step they took was to mark and mail this coupon. Make *your* start the same way—and make it right now.

Mail the coupon today for Free Booklet

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7697-D, Scranton, Penna.
Oldest and largest correspondence schools in the world
Without cost, please tell me how I can qualify for the position or in the subject *before* which I have marked an X:

BUSINESS TRAINING COURSES

☐ Business Management	☐ Salesmanship
☐ Industrial Management	☐ Advertising
☐ Personnel Organization	☐ Better Letters
☐ Traffic Management	☐ Show Card Lettering
☐ Business Law	☐ Stenography and Typing
☐ Banking and Banking Law	☐ Business English
☐ Accountancy (including C.P.A.)	☐ Civil Service
☐ Nicholson Cost Accounting	☐ Railway Mail Clerk
☐ Bookkeeping	☐ Common School Subjects
☐ Private Secretary	☐ High School Subjects
☐ Spanish ☐ French	☐ Illustrating

TECHNICAL AND INDUSTRIAL COURSES

☐ Electrical Engineering	☐ Architect
☐ Electric Lighting	☐ Architects' Blueprints
☐ Mechanical Engineer	☐ Contractor and Builder
☐ Mechanical Draftsman	☐ Architectural Draftsman
☐ Machine Shop Practice	☐ Concrete Builder
☐ Railroad Positions	☐ Structural Engineer
☐ Gas Engine Operating	☐ Chemistry ☐ Pharmacy
☐ Civil Engineer	☐ Automobile Work
☐ Surveying and Mapping	☐ Airplane Engines
☐ Metallurgy ☐ Mining	☐ Agriculture and Poultry
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Millions Are Committing Slow Suicide

(*Continued from page 11*)

in combination, are known to have caused death at Bellevue, and no doubt elsewhere. In many doubtful instances they are presumed to have had part in causing death. And in instances almost innumerable they are presumed to have contributed illness. The fact is that the symptoms arising from use of these substances in combination and in alcohol are so varied and so new in kind that nothing short of an autopsy by an expert tells the tale.

In other words, if we drink hooch, our bodies are likely to deceive us and our doctors as well.

But dead men tell no lies.

So I went to a man who knows more about dead drinkers, I am told, than anyone else in America.

ALEXANDER O. GETTLER is the toxicologist in charge of the Medical Examiner's Office in New York City. He is an authority on poisons and often called on to testify throughout the East. He is also associate professor of chemistry in New York University and is in charge of the chemical analyses made in Bellevue and Allied Hospitals.

He estimated, though the count has not carefully been made and in the confused state of diagnosis could not at best be considered final, that during 1925 there were 500 deaths—almost ten every week—directly or indirectly due to hooch, in Bellevue. Many of these, he said, occurred in the medical wards. And in addition, he stated, there have been hundreds of cases showing the cumulative as well as immediate effects of drink, including not a few showing signs of metal poisoning presumably caused by contact of alcohol and its current compounds with metals such as tin and lead.

"PROHIBITION has brought about conditions that amount to an entirely new problem," he told me. "In many instances it is impossible, short of a chemical and microscopic examination of brains and other organs, to say specifically that death came from this or that poisonous substance taken internally in drink. We can't explain most of our alcoholic deaths without autopsies. Most of them do not show conclusive signs of one poisonous substance or another. Death usually results from congestion, or, to put it in popular language, from the failure of one or more organs to function. The effect may have been immediate. It may not.

"And so far as we know there has been no scientific analysis anywhere in the United States of the physiological effects of hooch in its variety of forms. Recently, however, federal authorities have become interested, have sent representatives here, and we have been encouraged to undertake systematic analyses with a view to testing out theories we have.

"Our main theory is that there is residue from denaturants that the Government requires manufacturers to put in industrial alcohol to make it undrinkable.

"This, though, is only one phase of the problem as we see it from our office.

"There are two major classifications of modern whiskey. One kind is that made from industrial alcohol duly cooked and doctored with caramel and bead oils such as creosote and glycerine, along with perhaps some rye extract or Scotch extract or whatever else it needs, even a little real whiskey. The other kind is the moonshine stuff which contains free acids and aldehydes and differs in other ways from the synthetic liquors.

"Formerly, of course, all whiskey, except the 'third rail' variety, was aged in charred barrels, with the result that various substances which are not desired combine with one another in what we call esterification. Not much is known about the esters except that they are less poisonous than the substances from which they are formed, and that they have a smooth taste. In freshly made whiskey there is, of course, no opportunity for poisonous substances to neutralize one another.

"OUR theory is that poisonous substances, like those taken internally day after day by habitual drinkers of modern booze, keep on gradually affecting the various organs and nerve centers until they are reflected in illness of one kind or another and finally produce death."

Another Bellevue official, an ardent "dry," by the way, and a student of alcoholic and mental cases, added:

"In New York State the Hospital Commission reports that insanity from use of alcohol has trebled in five years. I doubt the accuracy of these figures, because the symptoms from use of the stuff drunk these days are different. A better check, and still not a conclusive one, is that of the Metropolitan Life Insurance Company. Reporting for seventeen million industrial policy holders, it says that though the death rate in general was slightly lower in 1925 than in 1924, there was an increase in the rate for influenza and pneumonia, which is frequently aggravated by alcohol; a marked increase in diabetes and cirrhosis of the liver; and, as between 1920 and 1925, an increase of nearly five hundred percent in the deaths reported—how accurately no one knows—from alcoholism."

AS A fact, no one really can say past all question what the new hooch, the new chemistry, the new chemical warfare on our bodies, is doing to us altogether.

But this we know:

Nothing whatever that we take into our bodies—not even the air we breathe—is without its effect; that there is not one chance in ninety of prohibition hooch being up to the brag; not one sound argument—except slow suicide—for its use.

IT MAY interest you to know that when one of our pupils suffered a breakdown and was ordered to bed for two months, our faculty advisers and editorial staff jointly decided that a subscription to a good magazine would mean much to him. So POPULAR SCIENCE MONTHLY was at once selected.—H. A. W., St. Paul, Minn.

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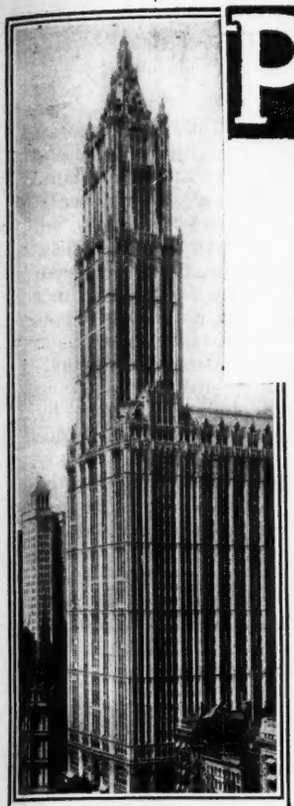

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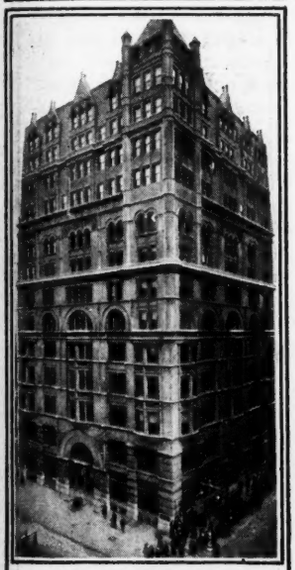

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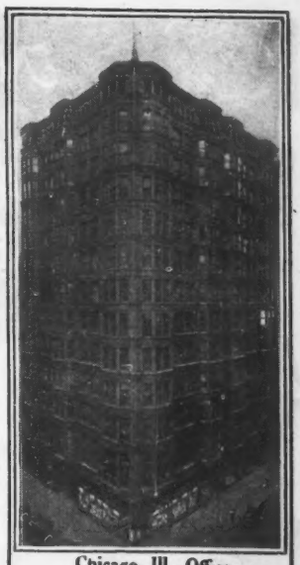

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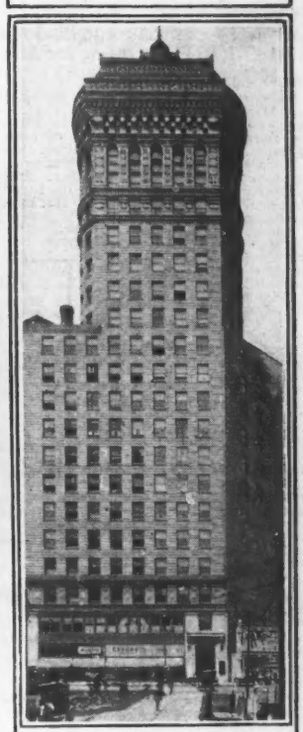

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Old Patent Models at 25c Each!

(*Continued from page 25*)

work of some stonecutter inspired with the idea of "putting more life into graveyards." In place of the usual epitaph, the inventor had inserted in the stone a circular glass case, enclosing a lifelike picture of the deceased.

Almost as odd was a model violin which bore the date of 1857. It was easy to imagine that its creator, one William Randle, had been troubled in his fiddling with broken strings, for to the tailpiece of the violin he fastened four spiral springs to which he attached the strings!

All the while, as Sam lifted the models down from the shelves, he proudly demonstrated each in turn. "See, here's the idea," he would say, turning a wheel or pushing a lever to make the thing go. At last, however, he came to one labeled "Converting Motion Machine," a tangled array of brass wheels and rods.

"THIS one here has me licked," he said finally. "Your guess is as good as mine. The fellow who made that must have spent his life at it."

An equally complicated machine of wheels and cogs was labeled "Fog Alarm." The secret of just why the fog should make it run was another one of the mysteries that lay buried in Cohen's cellar.

"We had a lot more of this brass stuff," said young Cohen, "but we scrapped it all for what we could get out of it. We paid anywhere from half a dollar to five dollars apiece for these models; that Edison invention you saw out on the car cost us one dollar and ten cents. We figured we could find people who'd want the models; for they say, you know, that the whole world passes through Orchard street at some time or other. But the only ones who have bought them have been a few mechanics who could use the parts, and a few curiosity hunters. You'd think people would want old inventions, but who does?"

Who does? In other dark holes beneath the East Side pavement I subsequently found other piles representing more hundreds of ideas. What will become of them? Will they, too, finally end in the junk yard? And will a similar fate overtake thousands more of the models stored in the warehouse in Baltimore? Of these, I learned, about 500 have been sold, most of them to relatives of the inventors or to friends who have a personal interest in them.

THE other day, for example, a young man who visited the warehouse inquired for a cert in model, giving the number of the patent.

"How about twenty dollars? Would that be the right figure?" he asked hesitatingly, when a salesman brought him the model. The salesman agreed.

Eagerly the purchaser paid his money and tucked the device under his arm.

"Now that it's mine," he said jubilantly, "I don't mind saying that I wouldn't sell it for a thousand dollars. It was made by my grandfather when I was a boy, and we've always wanted to get it back in the family."

The invention was a nondescript device for lifting water, which had gone the way of many patents and had never been applied. As a machine it was unimportant, but as a family treasure it had sentimental value.

The Baltimore owners of the models, J. S. Lee and Bernard Shapiro, have adopted a systematic method of searching out and interesting relatives of the inventors by mail. For instance, they have corresponded with the Westinghouse family in Pittsburgh concerning a switching apparatus for telephones patented by George Westinghouse in 1881—a device for enabling "central" to connect any subscriber with any other line in the exchange.

There are, then, some who value old inventions, although obviously such a market is extremely limited; and so, in this strange morgue, the vast heap of models lies virtually unwanted and unclaimed.

What if the inventors themselves could live again to visit the graveyards of their handiwork—the pushcarts of Orchard street or the warehouse in Baltimore? Would they call us an ungrateful generation?

I am inclined to believe that some of them—at least those who made real contributions, however small, to the sum of inventive science—would simply smile at the little joke which the fates have played. For after all, the battered and dusty patent models which Uncle Sam has swept out-of-doors were merely the first expressions of ideas. The ideas themselves live on, giving birth to other and better ones that we can put to use.

Who knows but that from the clutter in Sam Cohen's cellar may sprout an invention worth far more than all the "junk" that lies there? Stranger things have happened.

Millions of Invisible Stars

MILLIONS of small stars frisk about on the outskirts of the universe, according to astronomers. The famous spiral known as the Great Nebula of Andromeda, which seems no larger than the full moon and very faint, is made up of such stars.

Through a small telescope the spiral looks as if it were surrounded by a cloud. On examination with a great reflecting telescope, however, a vast number of faint stars are seen on the outer edges of the spiral. These are 100,000 to 1,000,000 times dimmer than the naked eye stars, and so far away from the Earth that it takes one of their twinkles a million years to reach us.

THE prize winners in the first of our remarkable series of "What's Wrong" contests, which started last March, will be announced in the next issue of POPULAR SCIENCE MONTHLY. As in the contest this month (see page 12), $1,000 in sixty-three Cash Prizes will be awarded those who submitted the best lists of mistakes in the John-and-Mary picture. Look for the first list of winners in the August issue, on the news stands July 10.

Around the World in a Yawl

(Continued from page 23)

among the clouds. That evening I landed at Taiohai in the Marquesas, my first stop."

Cruising between the islands, Captain Pidgeon insisted he had no adventures. But casually he mentioned being pursued by a shark.

"One day near the Island of Uapu," he said, "there was a calm, and I went swimming. After a while I noticed a commotion in the water. As I climbed back on the boat, the jaws of a shark grazed past my leg."

AFTER leaving Cape Town, South Africa, he had his only serious mishap. "I was clinging close to the shore," he explained, "and it was bad weather. For two days and nights I hadn't slept. I set a course that should have taken me clear of everything, then I went below, to sleep.

"Suddenly I was awakened by a dull thud. I had struck something. The boat bumped again and keeled. Through a porthole I saw a white streak. It was shore. The boat kept washing further up, tilted over on one side. I crawled into my bunk and slept until dawn.

"In the morning I walked inland until I found a Dutch farmhouse. The people there helped me, and in three days I was ready to put to sea again."

Skirting the northern end of South America, the *Islander* had another close call.

"I was awakened at midnight," Captain Pidgeon narrated, "by a bumping sound. I stuck my head out of the cabin and there to the leeward was a huge black mass.

"'STAND by for a line!' someone called out of the blackness, and I was hit on the head with a rope. A British tank steamer had seen my light bobbing around, and, thinking it a boat in distress, had come to help me.

"'Get out of here!' I yelled. 'I don't need help. You'll wreck me!' A huge wave nearly tossed me on the deck of the steamer, but another washed the *Islander* away. As she fell back, the side of the steamer struck her bowsprit off and the port mizzen shrouds were washed away.

"There I was in a heavy sea, disabled. I lashed the tiller and rigged the jib so I could handle her. At daylight I managed to make repairs enough to get me to Port-of-Spain."

Curiosity still demanded details of how he managed. How about food?

"I carried mostly dried food, beans, peas, rice and wheat," he told me. "I drank only water. I carried one hundred gallons of it. On the islands I got sweet potatoes, bread fruit, yams, and mangoes.

"Danger? There wasn't much. Of course the danger of going alone like I did is losing your footing on a slippery deck and falling overboard. The boat would go sailing off, and you couldn't catch it.

"But I never slipped."

Where to next? Captain Pidgeon himself doesn't know. But should he take a notion to see any spot in the world, for that place will he set sail.

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When to Do Odd Jobs

(*Continued from page 37*)

it. This is wasted effort. Get the correct material and put it on quickly. You need only a pot of homemade flour paste and a few tools for the job.

Flush out the hot water tank to remove rusty sediment that damages and may stop flow in small outlet fixtures. It is not enough to open bottom faucet, since vacuum will keep the tank from draining completely. Open top faucet or unscrew top plug.

Clean roof gutters and leader traps of leaves and rubbish. Sometimes a bird's nest chokes a leader, with expensive consequences. Rubbish left to freeze in the gutters makes endless trouble.

This is also the time to glaze broken windows. Where the old putty is hard, the amateur spends an hour or two digging it out. The expert does not attack the putty, but cuts a thin shaving of wood beside it with a sharp knife. Better measure size of new glass after taking out old one, so as to insure correct fit.

NOVEMBER. Take off screens and screen doors. Even a copper screen should not be left in place, for the weight of snow will cause it to sag. Rake and remove, or burn, leaves around house. They may be turned into compost for the garden. If used to bank foundation or shrubbery, cover with earth. See that outside drains around house are not choked with leaves or other rubbish.

When starting steam plant, you may need to clean water glass. It can be done easily without removal and risk of breaking glass. Have ready a wire-handled earthenware cup or jar filled with a half pint of water and about a teaspoonful of muriatic acid. Get up five pounds steam pressure. Close both wheel valves on glass. Open petcock below glass and immerse it in acid mixture. Then alternately open and close upper wheel valve. The down-rushing steam condenses, makes a vacuum, so that the liquid is drawn into the glass and speedily cleans it. When done, close petcock and open wheel valves as they were before.

DECEMBER. Turn off water from outdoor fixtures likely to freeze, or protect them with heavy insulation of felt, cloth, paper, sawdust, and the like. It is well to have a water-tight box covering insulation. Remedy last year's trouble of no access to outbuildings because doors would not open against frost-heaved ground. Probably the garage can stand a little more cold-proofing. Double windows will help it a lot, so also will sealing all chinks with felt or just rags. I keep a thermometer, readable from outside, hanging between the double windows of my garage, and know thereby when it is advisable to increase steam heat or add alcohol to the car radiator.

If leaks develop in the heating system, whether in furnace, iron pipes or radiators, you can repair them by applying iron cement or boiler compound, a liquid for interior use in boilers or hot water radiators. Iron cement is a powder which must be moistened with water to a paste. Pack it into a file-cleaned crack or leak, and let it harden under moderate heat for about twenty-four hours. A steam radiator so repaired has been tight for a decade.

Beware of the wood box filled with old papers and other rubbish. It is a great fire menace. Get rid of it, and keep very little paper and split kindling to start fires. Oily rags are even more dangerous, since they are likely to burst into spontaneous flames at any time. Keep furnace ashes away from woodwork. Never stoke a furnace, kitchen stove or open fire to make a roaring, red-hot blaze. It warps grates and plates, damages smoke pipes, and may cause a dangerous conflagration of soot in the chimney. Grates are also warped when ashes are left to pile up high in the ashpit.

JANUARY. Shovel off surplus snow from low-pitched roof. Too much weight left on long enough will bend or break a roof. Keep ice from clogging leaders or breaking gutters, or damaging electric light and telephone wires.

Watch the plumbing system when the thermometer drops. Thaw frozen pipes with a chemical that generates heat, with boiling water or a blowtorch used with care. It is better yet to thaw with steam, especially in a bathroom and in inaccessible places. Take a kettle with a rubber tube four or five feet long attached to spout. Boil water over alcohol stove, plumber's gas stove, or with blowtorch. Direct the steam where needed on the pipe. By this method there is no damage to the plumbing and no danger of starting a fire in adjacent woodwork. If a blowtorch is used to boil the water, better rig up a kind of stove to spread the heat. Fit a kettle to the top of an old iron paint can that is clean; make hole in side for torch flame to enter; insulate bottom of can with asbestos.

Look out for a frozen gas line which may thaw and flood room with gas from cocks left open. There should be a chemical fire extinguisher kept in the kitchen, handily placed. This applies to every kitchen everywhere.

FEBRUARY. If you hire a painter for inside work, engage him during cold weather: he is not so busy then and will do a good job. The same may be said of paper hanging.

Make drainage paths for melting snow around the house, so as to prevent an unexpected flooding of the cellar with dire consequences to the heating plant and what-not. Open outside drains with salt and hot water. If cellar or basement walls leak, plaster inside with cement. Even a small spring may be stopped by weighting down against it a half-open tin can or section of tin pipe and filling with dry portland cement. For quick work, including outside emergency jobs, use the new twenty-four-hour hardening cement. This develops heat while it is setting so that it can stand winter temperatures. It has an aluminum base, is brownish in color, and is handled in about the same manner as ordinary cement. One part cement

(*Continued on page 119*)

When to Do Odd Jobs

(Continued from page 118)

to two and one half parts sand is right for most plastering and waterproofing.

Add water to steam boiler, clean furnace flues. The former needs to be done only a few times through the season as indicated by glass gage, but the flues should be cleaned at least every two weeks. With soft coal, twice-a-week cleaning may be required. A layer of soot one-sixteenth inch deep wastes one quarter of our fuel.

Tinker furniture. Mend locks and bolts. Practice a little upholstery.

MARCH. Look over screens and screen doors, mend holes, paint frames and also mesh if not copper. Holes can be neatly woven over with wire unraveled from a bit of mesh. If the mesh is badly sagged, remove molding and enough tacks beneath; pull edges taut with pliers and refasten. The lower half of a screen door subject to damage by family dogs and cats may be reinforced with an extra layer of wire cloth. If the frames are warped or giving way at the corners, reinforce with small angle irons, interior or flat.

Inspect attic for roof leaks and mark with chalk damp spots for later repair. Of course the actual leak may be higher up than the spot where dampness shows, and some leaks occur only when drifted snow dams and backs up water on roof—as around dormer windows and in valleys. Such abnormal leaks, unless extensive, are not very important.

APRIL. Repeat October flushing of hot water tank. Clean up rubbish, including leaves, ashes, and banked material, around house. Hard coal ashes are good to make paths and as filling under cement walks; also to lighten heavy soil in the garden.

Take off storm doors; repair, if needed, and store. Flush out refrigerator drain.

Note effect of winter frost on foundations, sidewalks, drains, etc., so as to repair during summer. There may be cracks, bulges and depressions that indicate broken tile under ground. Winter experience may point to a grading job later on, whether terrace, retaining wall or shallow surface ditch to supplement underground tile or broken stone.

MAY. Put on screen doors and windows. Open attic windows or ventilators. Clean cellar; whitewash if necessary. Kerosene sprayed on cement floor before sweeping keeps down dust and purifies. Ventilation and cleanliness are not only hygienic measures—they prevent decay and deterioration of the house from cellar beams to rafters.

Drain heating plant, if steam, refill with water to safety valve, rake out flues, remove smoke pipe, clean and put aside. With hot air plant, take down pipes and clean; patch heater with stove cement.

Do inside painting and varnishing before flies arrive. Also paper or decorate rooms. If bronze or aluminum is applied to radiators, the job is better done with a little heat on. Ordinary paint can be used instead.

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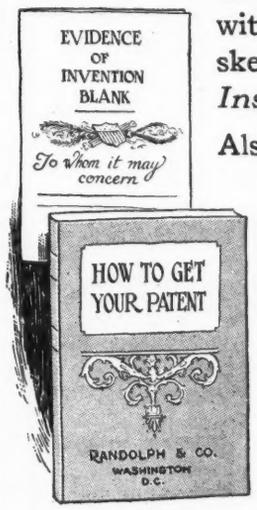

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See the Cash Prize Offer on Page 4

Questions about the Test Picture on Page 29

HAVING studied the picture of the automobile accident on page 29, you are now to answer the following fifteen questions, using the blank spaces. Allow seven minutes to complete the answers.

1. At what street intersection did the accident occur?
   Answer:.....
2. What is the condition of the weather?
   Answer:.....
3. From what state is the automobile?
   Answer:.....
4. On which side was the automobile struck?
   Answer:.....
5. About what hour of the day did the accident occur?
   Answer:.....
6. Name three ways in which the automobile was damaged.
   Answer: (a).....
   (b).....
   (c).....
7. What is the number of the street car?
   Answer:.....
8. To whom does the automobile belong?
   Answer:.....
9. Does anything show that the driver lost control of the automobile?
   Answer:.....
10. What is the route of the street car?
    Answer:.....
11. What is the number of the street car employee?
    Answer:.....
12. What is the date of the accident?
    Answer:.....
13. Name two things which indicate that the driver was killed rather than only injured.
    Answer: (a).....
    (b).....
14. Who is the person most likely to be called as a witness of the accident?
    Answer.....
15. How is the policeman attempting to identify the driver?
    Answer:.....

Now refer back to the picture and check your answers. How many of them did you get right? A trained observer would be able to answer at least ten of the questions correctly.

Test of Clear Thinking

The correct answers to the seven questions are: 1. false; 2. true; 3. false; 4. true; 5. true; 6. false; 7. false.

Score one point for each correct answer. The average score is six.

Connecting Ideas

The following words or their synonyms are correct: tree, disease, month, fish, drug, meat, boat, fruit, ocean, mountains, coin, book, vegetable, river, crime, animal, bird, city, game, flower.

An average time of a second and a half per word is good.

Does Your Pen Reveal Your Character?

(*Continued from page 22*)

compressed letters as a sign of a reserved, rather reticent person. Margins, or their lack, have much the same meaning to believers in this art. An apparent desire to let not a quarter of an inch go to waste on either side bespeaks a penurious nature; the reverse, excessive generosity or extravagance. An even margin shows good taste. When each succeeding line starts a little nearer the left edge of the paper, especially if at the start the space is quite wide, the writer, though temperamentally inclined to be exceptionally free-handed, has sufficient power of will to control the urge, and will be thrifty. When the reverse is the case—the first line starting quite near the edge, the next further to the right, and so on down to the bottom—the unfortunate possessor of that hand will never, graphologists tell us, have more than enough in the bank—through his own efforts, of course—to cover his withdrawals. It will be discovered, too, that in the last named there will be a tendency to leave a greater space between succeeding lines.

THE breaking up of words into sections or syllables is supposed to be indicative of the inductive faculty. Here is the rider of hunches, the man or woman who will make a decision frequently on instinct rather than cold reason. The analytical mind is revealed in connected words. Often these attributes are found in the same specimen. A word will be broken in the middle, and at the same time be connected with the word that follows by means of a loop or tail. Which of the two rules—induction or deduction—may be discovered by a comparison of the frequency of the traits.

The manner in which you bring a word to an end is examined with scrupulous care by the inquiring graphologist. If you have a tendency to terminate with a graceful curve that points up and to the right, it is an excellent point in your favor. He will credit you with imagination and impulse. If, however, the curve is back over the word, or points down, either straight or hooked, you have cause for alarm. That will probably be read as selfishness. Worse yet is the terminal that not only descends but tends to broaden. This may mean stubbornness, or may simply be the sign of self-opinionativeness, depending upon the width of the stroke. The latter attribute is also read in a line extending to the right and broadening as it comes to a halt.

WHEN no terminal exists, that is, when the word is bitten off without any attempt at flourish, economy is indicated to the graphologist; and, if he finds other signs of parsimony in the hand, such as small writing and exceedingly narrow margins, he may regard it as avarice.

Ill health, in particular any heart trouble, can be told from the handwriting, graphologists assert. The sign is a hook-shaped quiver, generally occurring at the top of the stroke. In support of this contention Dr. Smith cites a case in which one of his clients might have been saved a large sum of money had his advice been followed.

A large commercial house that maintains branches throughout the country needed a new manager for its San Francisco office. A department head in the New York office was selected to fill the post, but before sending him out the firm took the precaution of having his handwriting analyzed by Dr. Smith.

The report was encouraging in every respect save one. The man's character was excellent; his writing revealed considerable executive ability. But Dr. Smith advised that he be not sent.

"The filling of this position involves considerable expense," he said in his analysis, "and I should therefore advise that you select another, since this man is liable to drop off at any time. His heart is bad."

THE head of the firm ridiculed the idea. His choice was a man of fine physique; he rarely missed a day due to illness. And, although Dr. Smith's analyses had been found surprisingly accurate in the past, his judgment was on this occasion overruled.

Three months later graphology was grimly vindicated. The new San Francisco manager dropped dead at his desk.

The buoyant, hopeful, ambitious person, we are told, will invariably write uphill; the pessimist, the man who believes his life is a failure, or the invalid, will reveal that state of mind by permitting his lines to droop toward the lower right hand corner. For that reason it is essential that specimens be prepared on unruled paper if a complete analysis is to be made.

Self-control as well is determined by discovering the deviation from the horizontal. Let's assume that a person is naturally of an exuberant nature, but his position demands that he preserve a dignified mien at all times. Eventually this becomes a part of his character; he is eternally suppressing his rising spirits. Graphologists tell us that this characteristic will be revealed plainly in the man's handwriting. Each word will rise toward the end, but a return to the normal plane will be made on the word following. A person who is exuberant and excessively ambitious will write with a very noticeable trend toward the upper corner.

ON THE other hand, a person may be by nature morose but, aware of the demoralizing effect, will set a check on himself. His words, then, will have a tendency to pitch down, but will be brought back on each fresh start, or the word itself may be reined back into place before it is finished.

I saw a startlingly accurate example of this in a letter I received from a friend who was spending several months in the country recuperating from a severe illness. At the start she had several encouraging bits of information. Her health was making rapid progress; friends had visited her the day previous, leaving her in a very cheerful mood. (*Continued on page 122*)

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Does Your Pen Reveal Your Character?

(*Continued from page 121*)

The writing of those paragraphs had a distinct rise.

"But," she continued, "it's raining now. I can't go outdoors. In addition, I've just received some depressing news from home." And while she was describing her feelings regarding the weather and the family troubles, her writing took a decided pitch downhill!

The manner in which the capitals are made is said to be indicative of the taste of the writer. Those most nearly resembling the printed letter—but in script form, however—bespeak artistic taste.

THE graphologist pays strict attention to the punctuation. When the *i* is not dotted, it may either indicate indolence or great mental activity, depending on the rest of the writing. The basis of such reasoning is this: a person may neglect the dotting simply because it is too much trouble to bring the pen back, or his mind may be so full that it races ahead of the slower moving hand.

A dot made in the shape of a dash naturally suggests impetuousness. When it is placed directly over the letter, you are apt to think of a person who has "a place for everything and everything in its place."

How many times have you seen a writer sort of slash a period at the end of a sentence with an air of "Just let me see you contradict that!" Such a movement has the effect of making a wedge of the mark, which is read as you would expect, as a sign of irascibility, violence or irritability.

AND now for the *t*, the great revealer, say practitioners of this art. Some list more than a hundred variations, each with a different shade of meaning.

The same rules hold with regard to the position of the crossbar as apply to the dotting of the *i*'s. When to the left, dilatoriness; right, impetuousness; flying high, imagination and ambition.

The despot is revealed in the writing of a person who crushes down his *t*'s with a short, thick bar. "Take that!" he seems to say. A person naturally quick-tempered, but one who makes an earnest effort toward control, will, we are informed, start slashing the *t* with a heavy stroke, then, suddenly repenting, will lighten the pressure so that the line thins out at the end. A long, light bar, generally with a slight curve to it, is supposed to signify wit and good humor. When carefully placed in its proper location and made with just ordinary pressure, the *t* bar will bear out other signs of orderliness and conscientiousness. Possibly the worst crossing of all is that made with a fairly light pressure at the start, then broadens, to finish in a sort of brutal slash. That is the unwelcome attribute it betrays—brutality.

The capital *M* is the most important single letter in the graphologist's alphabet. In its best form it is made with all strokes equal in height and well separated. When the first stroke towers over the others, self-esteem is present, to a greater or less degree, depending upon the distance the stroke projects above the others. When the first stroke is the smallest and the last the most prominent, bad taste is revealed as well as an excessive imagination.

The care with which punctuation marks are inserted is said to be in direct proportion to the sense of order of the writer. I chanced to see a specimen of the hand of Gerald Chapman, the bandit, written just a few hours before he was hanged not long ago in the Wethersfield, Conn., prison.

EIGHT hours before Chapman went to his death, the board of pardons met at the prison for a last-minute consideration of his case. He had been told he would not be permitted to appear, but at the very last moment the board summoned him. Not expecting the call, he was totally unprepared, and while waiting to be ordered to speak he employed himself listening to his lawyers' pleas and making notes on what he himself should say. The adamant attitude of all the members of the board revealed their answer while Chapman scribbled. He knew he was to die on the gallows. Yet, while the dangling noose cast a shadow across the page, Chapman punctuated those notes carefully, even to the extent of placing an exclamation point after an idea that he regarded as preposterous! Unfortunately, those notes were made in pencil, rendering them unfit for publication. There is, however, another specimen of his writing reproduced on these pages.

There is one sign that hardly fits into any of the arbitrary subdivisions enumerated above, and it is considered by graphologists a very important one. It concerns the manner of fashioning the small *a*, *o*, *d* and *g* at the top of the loop. When tightly closed, they signify a closed mouth. The writer would not be inclined toward communicativeness. On the contrary, he would be adjudged secretive. Wide open tops are marks of garrulity; partly open, they indicate a frank, communicative nature.

A deceitful person, it is said, permits his words to trail off into a series of unintelligible waves or undulating strokes. The basis of this deduction is that the writer, accustomed to dissimulation, instinctively attempts to conceal his real thoughts by rendering the words undecipherable. Refined, the vice is changed into the attribute of tact.

GRAPHOLOGISTS agree emphatically that fine, copperplate writing is not to be desired. There's no character in it, they say. It is indicative of the machine mind that does exactly as it is told. Persons of great intellect often write an illegible hand, which should not be confused with the chirography of the deceiver. Letters may be slurred over, but there is no evidence of concealment.

This, of course, is but a mere outline of a fascinating study. There is sufficient here, I think, however, to permit the investigator to make tests if he wishes to determine whether graphology should be placed in the ranks of the sciences.

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Rubber Made from Oil

(Continued from page 26)

of Technology, and Earl P. Stevenson, of the Arthur D. Little laboratories, Cambridge, Mass.

Stevenson declared that synthetic rubber is more than a fancy.

"It has not only been realized in the laboratory," he said, "but during the war it was produced in large quantities in Germany. It can be made from a certain class of hydrocarbons that are produced in huge quantities in every petroleum refinery in this country."

THESE are the substances which, if left in gasoline, form gums and stick up the valves of your automobile. To remove them, the petroleum industry each year suffers a loss close to 90,000,000 gallons of motor fuel, worth almost $9,000,000. Yet in so doing it throws away what might be of enormous value not only in supplying the demand for rubber, but in creating countless other useful by-products.

Meanwhile important experiments in growing rubber in the United States have been in progress. In experimental gardens in Florida, California, and in arid lands of the Southwest, the Department of Agriculture is growing some twenty different varieties of rubber producing plants. Moreover, experts of the California state department of agriculture have been experimenting with milkweed and other weeds, shrubs and trees that provide latex, and some time ago Henry Ford began planting weeds of the latex variety in his experimental farm at Dearborn.

AT THE same time attempts are being made to perfect a method of producing from old and worn-out rubber a pure product equal in quality to the crude rubber as it comes from the plantations. One of the most interesting is a machine recently invented by Eugene Royer, a French engineer. This machine devulcanizes the old rubber by subjecting it to great pressure and exposing it to certain gases. Objectionable chemicals and by-products are removed and the rubber is liquefied and filtered, until the result is of high quality.

How effective such a machine will be in relieving a world rubber shortage remains to be seen. While heretofore reclaimed rubber, when mixed with new rubber, has proved satisfactory in manufacturing certain articles, when used in automobile tires it has been found to decrease their durability in proportion to the amount of reclaimed rubber used.

THE success of attempts to grow rubber plants in the United States also seems somewhat doubtful. Trees planted now could not hope to supply the shortage predicted for 1930.

And so, it seems, we must look to the chemists, those miracle workers of science. It is not at all improbable that a large proportion of our tires in the future may come, not from the picturesque rubber groves of the Malay peninsula or Sumatra, but from the depths of oil wells and from the mysterious retorts of chemists' magic.

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Next Time You Buy Clothes—

(*Continued from page 32*)

models, and ½ inch to the bust measure.

Now about shoes.

"Most people make the mistake, in buying their shoes, of thinking they must stick to one size, which they regard as their size," said Charles H. Brown, of New York City, designer of footwear.

"THERE was the doctor, for example, who came in to us the other day and wanted a pair of size 8 shoes. We measured his foot from heel to ball, as we do in our stores, and had him try on his correct size, 8½. It fitted exactly, snug but not taut. He was perfectly satisfied, until he learned that they were 8½. Nothing would budge him—he must have his 8 shoes. We couldn't understand his obstinacy, until he finally exploded that nothing could make him believe that his foot had grown half an inch since he had bought his last pair!

"As a matter of fact, each half size is only 1/16 of an inch longer than the next smaller shoe. And lasts of different manufacturers differ from each other in the shaping.

"If I could give one rule by which you could test your own shoes, it would be, 'Always have the *feel* that the ball of your foot is resting snugly into the ball of the shoe, and not a trifle fore or aft of it.' "

If you wear a size 8 shoe, your foot is probably about 11 inches long; if size 10, it is about 11½ inches. But if you wear size 12½, foot length and shoe size finally approach each other—you are probably the proud possessor of a 12½-inch foot. This rather mystifying size scale comes down to us from the medieval shoemakers.

If you are in doubt about the size of your shoe, learn to read the code sizes stamped in them. There is usually a style number which you needn't bother with. But the size number is usually coded in one or another of the following ways:

THE code most commonly used is called the 32-system. First appears a number representing the sum of 32 and the size number of the shoe. Then appears a dash, indicating a half size. If a full size, the dash is omitted. Then comes an arbitrary number, always 1. Then any digit from 1 to 5, representing the width from A to E. Thus, if your shoe has these numbers, 39–14, you are wearing size 7½ D.

Another code puts the numbered equivalent of the width first, the actual size next, with a 5 for a half size. With this code, your 7½ D becomes 475.

Still another code starts with a 2 for a half size, next has the actual size, and finally the number for the width. This gives you 2 7 4 for 7½ D.

One house specializing in large women's sizes simply doubles the size and adds the numerical equivalent for the width, making 94 for 4½ D for example.

Concerning hats—if you want to hear some startling theories about hat sizes, ask any group of men what the size numbers mean.

As a matter of fact, if you wear a 7 hat, it doesn't mean that your head is either seven inches long or seven inches wide. You arrive at the number this way: Measure both diameters of your hatband, length wise and breadth wise; add the two together; and divide the sum by 2. If the length is 8 inches, the width 6, the sum will be 14. Divide by 2, and you have your hat size, 7.

As for women, they are only just beginning to discover that they have head sizes. Bobbed hair and the close-fitting hat are accomplishing that.

Women's hat sizes indicate the exact number of inches around the head. Thus, a woman who wears a 24 hat measures just 24 inches around her head.

Ten years ago, the average American woman wore a 24 hat. Today she is wearing a 22. The "woman with hair," as the milliners call her, is being hard put to it to find hats large enough!

AMONG all the clothiers and haberdashers whom I consulted, there was unanimity probably on only one point, namely: The average man is actually interested in only one single item in his entire wardrobe. That is, his collar.

"It is the one article, at any rate, which he absolutely refuses to wear if it isn't the exact size to a quarter of an inch," said one collar manufacturer. "Gloves, shoes, hats, anything else will 'go' if a little off-size, but not so the collar.

"The average American neck is 15¼ inches, but it seems to be the most elastic part of the body, next to the waist line. Collars run from eleven to twenty inches.

"Funny, too, the way men stick to their own ideas on the fit of their collars. Theoretically, your neck should measure exactly 15¼ inches for a 15¼ collar. That is, the collar measures 15¼ inches from the middle of one front buttonhole to the outer edge of the other. Actually, some men prefer one fourth or one half of an inch larger, and a few even one fourth of an inch smaller, and nothing on heaven or earth could change their view!"

Men's shirts are designated by the neck size, too, because that is the part that must fit exactly. The sleeve length is taken, with the arm crooked, not from the shoulder but from the center back of the neck to the wrist.

AT LEAST there's nothing mysterious about socks and stockings.

"Why, of course, a size 10 stocking means a ten-inch foot length," exclaimed the first hosiery maker I consulted.

"It is curious, when you think of it, that men never remember the size of their socks and never forget the size of their shoes. For they certainly buy socks three times as often as they buy shoes. Yet men come in again and again, look blank when the hosiery clerk asks the size, and finally say, 'I wear an 8 shoe—what size stocking goes with that?'

"It should be easy to remember, because the sock size is exactly the length of the foot. My own theory is that men remember their 8 shoes rather than the corresponding 11 socks because subconsciously the larger number makes them think they have large feet!"

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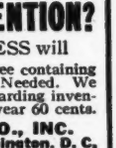

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What All Industry Owes to Eli Whitney

(Continued from page 34)

Haven, a group of his friends were at the dock to greet him with news of fresh disaster.

"Eli," said one of them, "only yesterday your shop was destroyed by fire, and all your machines with it!"

For a moment Whitney accepted the news in silence. Then, with a sudden gesture of disgust, he flung out his arms as if to sweep aside all his misfortunes.

"I have had enough," he said. "I have sacrificed everything, and for my pains I have been treated as a swindler and a villain. Today I am bankrupt; there is nothing left to me but debts. I have given the best years of my life to make fortunes for others; now I will make one for myself."

IT CHANCED, at this time, that Whitney heard of a project of the American government to manufacture its own firearms. Heretofore muskets, imported from abroad, had been made one at a time by skilled experts.

"It may require uncommon skill to make a complete musket," thought Whitney, "but certainly any mechanic of ordinary ability should be able to turn out *part* of a musket."

From that thought Whitney's active brain conceived the idea which not only carried him to financial independence, but which revolutionized manufacturing processes throughout the world. Instead of making muskets one by one, he would turn them out in lots of hundreds, and even thousands. He would design each part to a precise, standard pattern. Each of the several parts, in the course of manufacture, would pass through a succession of processes, and at each stage a workman would perform just one simple mechanical operation. In the final stage the parts, fitting exactly with one another, would be assembled into the completed musket, a process requiring ordinary skill.

Presenting this plan, with the financial backing of friends in New Haven, Whitney obtained a contract from the government for 10,000 muskets. Near a waterfall two miles from New Haven, he built his factory, constructed his tools and machines, and trained his workmen.

LITTLE record remains of just what his machines were, or how they worked. But we do know that they turned out superior muskets, and that manufacturers came from far and wide to marvel at Whitney's armory. We know, too, that the methods he devised were widely copied, and that they became the foundations for our modern industry.

So, because of the genius who went bankrupt making "cotton king," we who are living today can afford the many common necessities and luxuries which are vital to modern life. The automobiles we ride in, our typewriters and desks, our watches, knives, radios, sewing machines, farming machines, the shoes we wear—in fact, almost every conceivable article produced for our use in large quantities has been brought within our grasp through the struggles of Eli Whitney.

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first prepares a student by intensive practical work on motors, building, recovering wings, rigging and all details of construction, repairing and handling. This is called ground school work. Instructor Spencer, an overseas flyer, tells you that it took about 4000 mechanics and assistants to keep several hundred flyers in the air at his field in France. To show you the quality of the men who teach you look at Spencer and Wimer for instance. Spencer was an army pilot and has been teaching and doing commercial flying since 1917. Wimer is a college man, went overseas, was with the 1st Air Park, was an observer, spent over 200 hours in the air and since the war has been with two big aircraft corporations.

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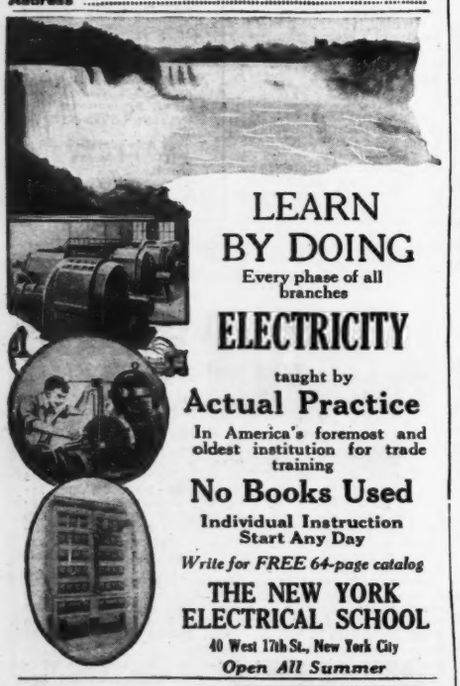

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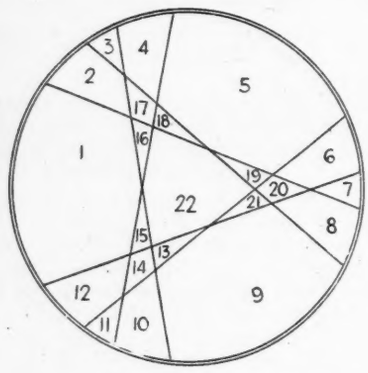


How Grandma Cut the Pie

With only six straight cuts of the knife, Grandma divided her pie in twenty-two pieces as shown, getting big pieces for the grown folks and small ones for the children.

The Florida Land Puzzle

Calling the width of the plot $3x$ feet, and its length $4x$, then its diagonal line would be $5x$. The dimensions of the large rectangle contained within the diagram would be $11x$ by $13x$, or $143x^2$ square feet. Four complete plots and four half-plots are located within the large rectangle, and the total area of those six plots is $72x^2$ square feet. The remainder of the rectangle's area, $71x^2$ square feet, constitutes the starlike park. The area of the eight plots equals $96x^2$ square feet, and cost $9,600. The park's cost, at the same rate a square foot, would be $^{71}/_{96}$ of $9,600, or $7,100.

Maggie's Age

In this puzzle it may be said that Maggie's present age is 12 to Tommy's 20, for when Tommy was 6 years older than Maggie is now, he was 18 and she 10, which is half his present age. In 14 years she will be 6 years older than Tommy's present age, or 26. Then Tommy will be 34 and mother 60.

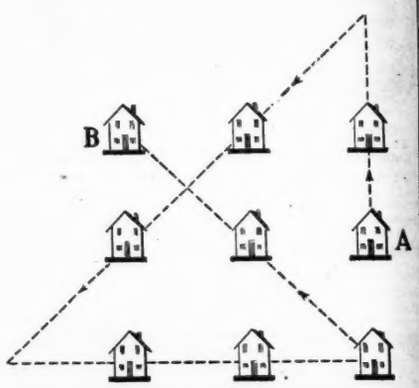
The Match Game

Considerable analysis is required to prove that the winning opening play is the removal of one match from the group of 8, leaving the other groups 3, 4 and 7. Other winning groups to leave for one's opponent are: 2, 4, 6; 1, 4, 5; 1, 2, 3; 1, 1, 1, or reducing the groups to two, 4, 4; 3, 3; 2, 2.

The Milkman's Puzzle

Let us call one of the ten-gallon cans A and the other B. Then:

Fill five-quart pail from can A. Pour five-quart pail into four-quart pail. Empty four-quart pail into can A. Pour five-quart pail into four-quart pail. Fill five-quart pail from can A. Fill four-quart pail from five-quart pail. Empty four-quart pail into can A. Fill four-quart pail from can B. Pour four-quart pail into can A, which fills can A, leaving two quarts in four-quart pail. Thus the milkman has supplied each of his customers with two quarts of milk.



The Poultryman's Route

This diagram shows how the poultryman can cover his route in four straight moves. To do so he must go a little out of the bounds of the neighborhood, but this violates no condition of the problem.

How to Foil the Auto Thief

(Continued from page 64)

and while he was away I discovered that there was a secret shut-off valve in the gas pipe under the seat that had jarred closed. It was a second-hand car, and the owner didn't even know that confounded valve was there! I only charged him half price, because it was half my fault."

"By jinks!" said Thatcher enthusiastically. "I am going to put something like that on this bus right away."

"Don't do it," advised Gus. "Even with the gas shut off, your car will run quite a ways on the gasoline in the vacuum tank, and if the crook can get out of sight he can stop and find the trouble easy enough.

"YOU go into the office with Joe now while I straighten out a few more little kinks here and pick out the kind of a lock wheel for you. We'll have to order it anyway. I'd suggest that you choose one of the kind that swings up out of the way when you get in and out of the car."

"All right," agreed Thatcher. "And while I am about it, I guess I'll get a good padlock and chain for the spare."

"I can show you something better than that," suggested Joe. "Put one of these locks on in place of the bolt that holds the spare tire on the rack. It's a lot better than the padlock and chain combination, because there's no way of cutting it with a bolt cutter, and besides that it can't rattle around and chip off all the paint."

"And how about a padlock for the tool box, too?" Thatcher inquired.

"We have them in all sizes and prices," said Joe as he pulled out a board with a lot of samples fastened to it. "Some of these are low priced, but a high-grade padlock is well worth while. It's stronger, almost impossible to pick, and it won't rust up and stick so you can't unlock it."

"Sort of like locking up the barn after the horse is stolen," grinned Thatcher. "Only in this case I've got the 'horse' back and don't want to lose him again!"

OF THE MANY magazines and journals that I take, POPULAR SCIENCE MONTHLY is the one that I feel that I could not afford to do without.—Mrs. M. A., Seattle, Wash.

Here Are Correct Answers to Questions on Page 48

1. The violinist plays by putting his finger on his strings at different places, and changing the length of the string. Since even a hundredth of an inch difference in length makes the string play a different note, he is able to play very many notes on four strings.

2. The pads of cartilage, or gristle, that line the joints, produce a fluid which acts as a lubricant, as oil in an engine.

3. The attraction of the moon, with some help from other heavenly bodies. As the earth turns, the moon attracts the water in the ocean and raises a bulge in it. This bulge is the tide.

4. To sprout, a seed needs proper temperature, water, and oxygen. During winter the seed soaks up water. In the spring the soil gets warmer and some of this water runs out. Air gets in and the seed obtains oxygen. When this and the temperature are sufficient, the seed begins to sprout.

5. Milk which has been heated to 110 or 120 degrees and kept there for about half an hour. This kills most of the bacteria, and the milk keeps better.

6. It comes as radiant heat, a kind of ether waves; the same as light, except that the waves are longer and invisible.

7. We have a tendency to imitate whatever we see other people do. Yawning when other people do so is simply one instance of this tendency. It is common because yawning is an easy thing to do.

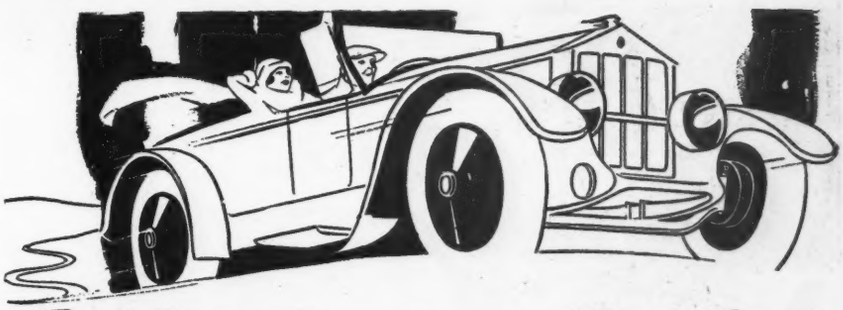
8. To produce low temperatures, often as low as 200 to 300 degrees below zero Fahrenheit. Such super-freezing temperatures are needed in taking the gas out of vacuum tubes for radio.

9. Many microscopic creatures have tiny shells made out of lime. Many bacteria also take lime salts out of water and make little particles of solid lime. This lime accumulates on lake and sea bottoms. Millions of years later, after it has hardened enough, it becomes limestone. Geologists believe that nearly all limestone has been produced thus.

10. By measuring the amount of water it "displaces," that is, the volume of the part of the hull that is under the water line. The weight of this water is the weight of the ship. Every floating body sinks until it displaces exactly its own weight of water.

11. The sun is shining above the clouds. Part of this light gets through, just as some light will shine through a white cloth.

12. In three ways. First, a mirage quivers and changes its shape as you watch it; a real lake seldom does this even from a long distance. Second, there is generally dark-colored vegetation around a real lake. Third, there are usually birds flying near and above a real lake.



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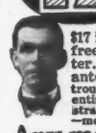

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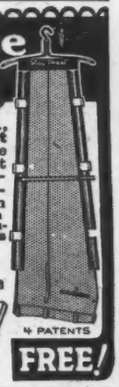

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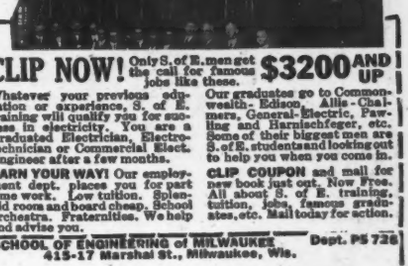

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